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THE
FORESTER'S GUIDE
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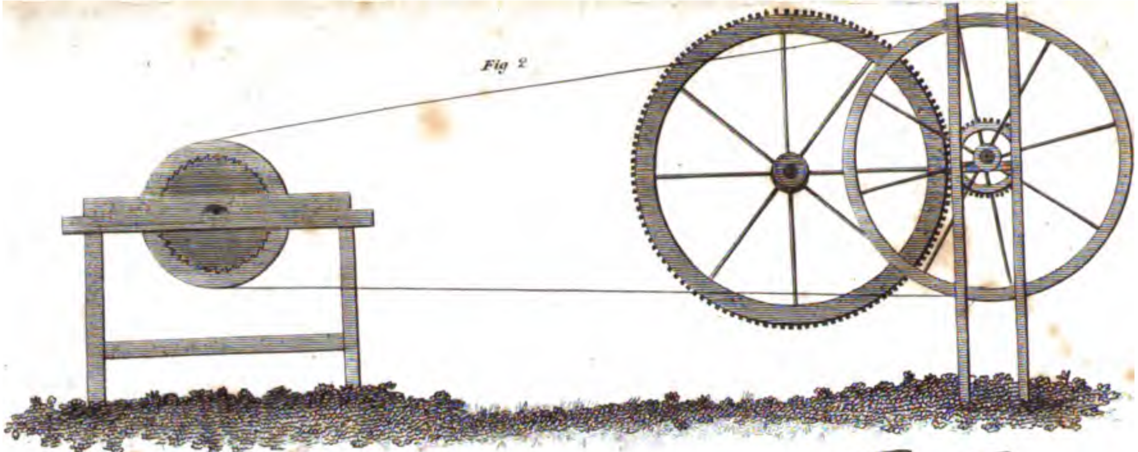
PLATE I

Fig 2



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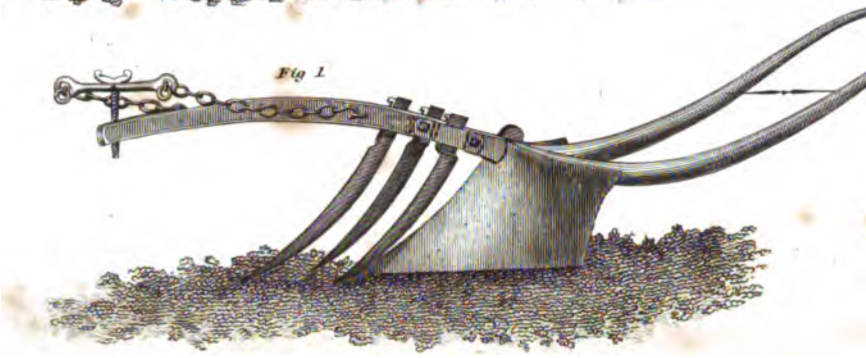

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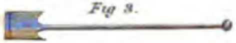

Drawn by J. Milne

Engd by T Clark

UNIV. OF MICH

THE

FORESTER'S GUIDE

AND

PROFITABLE PLANTER:

CONTAINING

A PRACTICAL TREATISE ON PLANTING;

WITH

NEW AND IMPORTANT DIRECTIONS

TO MAKE THEM SERVICEABLE FOR ORNAMENT, SHELTER, AND PROFIT:

ALSO,

A Method of valuing all kinds of Growing Wood:

TO WHICH IS ADDED,

THE PREVENTION AND CURE OF DRY ROT.

BY ROBERT MONTEATH,

FORESTER TO HIS MAJESTY.

THIRD EDITION, GREATLY ENLARGED AND IMPROVED.

ILLUSTRATED BY ENGRAVINGS.

LONDON:
PRINTED FOR T. TEGG AND SON, 73, CHEAPSIDE;
R. GRIFFIN AND CO., GLASGOW;
AND TEGG, WISE, AND CO., DUBLIN.

1836.

Forestry
Clark
1-4-29
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NOTICE.

THE Author directs the business of planting of every description, whether for ornament or profit—instructs as to the particular plants most suitable to situation and soil—directs their thinning and rearing to maturity—gives a proper system for the recovery of neglected plantations, and plans for their future improvement, to make them serve the triple purpose of ornament, shelter, and profit—values growing woods and timber, trees of all ages, whether these are for cutting down, or to be sold with the property.

Letters addressed to **ROBERT MONTEATH**, Forester, Edinburgh, will be forwarded and attended to.

ADVERTISEMENT.

I THINK it necessary to state that a great part of this Third Edition of my FORESTER'S GUIDE was written and put to press some time ago, but owing to circumstances over which I had no control, the publication has been delayed till now—any alterations I would have made upon it are very immaterial, and I have only mentioned the circumstance, because I have in some of my observations been anticipated by recent writers on the subject, and without this explanation, I might have been accused of plagiarism, while I was merely anticipated in the date of publication.

A recent writer on the subject, Mr. Mathew, has reviewed, with some severity, my system both of planting and valuation; but, in doing this, he has, either through ignorance or unfairness, taken as the subject of his review the First Editions of my Forester's Guide, overlooking subsequent works, and Miscellaneous Reports published in 1829, where he would have found improved experience had made me alter one or two things, and where previous inaccuracies are corrected.

But with respect to the principles of my system of valuation, I can appeal to the general accuracy of its results in the numerous and extensive valuations I have made in every part of Britain; and as to planting and rearing woods, I can also, as the best test of my system, appeal to facts. I can bring ample testimony of the success of my practice from numerous and extensive proprietors of the highest respectability, or what perhaps is still more satisfactory, I can appeal to the state of the woods themselves for a proof of the efficiency of the system.

However, it is some consolation to me that I have not suffered alone, Mr. Mathew has been equally petulant in his animadversions upon Forsyth, Sir Walter Scott, Sir Henry Stewart, and almost every other writer on the subject, and in such company I am disposed to take my share of castigation with much good humour; but, indeed, where it is only ignorance and presumption that find fault, there is no great merit in bearing the attack with magnanimity.

The extent of my professional duties has enabled me to give, in the present Edition, a great deal of new and important matter, which, I would fain hope, will prove both interesting and useful to Landed Proprietors, as well as Foresters and Mechanics.

ROBERT MONTEATH.

Edinburgh, June 16, 1831.

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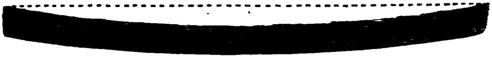
ERRATA.

At page 226, *for* labourer *read* laborious.
289, *for* Elm *read* Oak (head line.)
311, *for* arborist *read* arboriculturist.
417, *for* diseases of trees *read* transplanting large trees (head line.)
463, *for* prevention and cure of dry rot *read* mode of sale or lease of natural woods (head line.)

PLATE II

Fig 6



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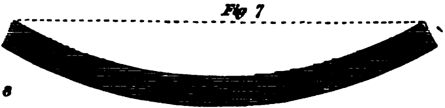

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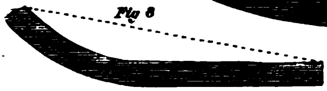

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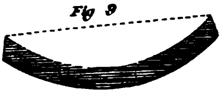

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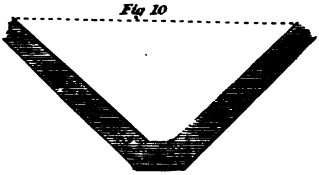

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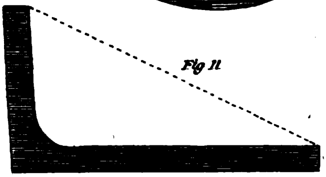

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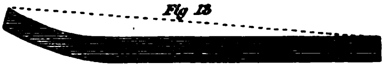

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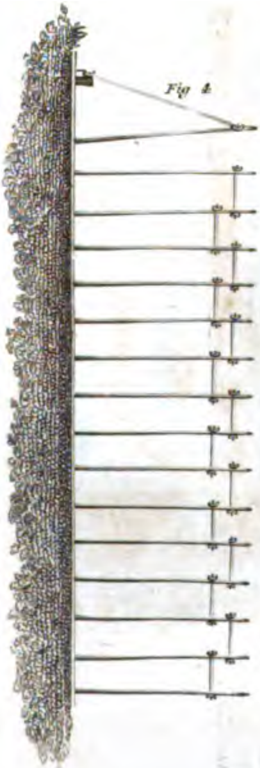

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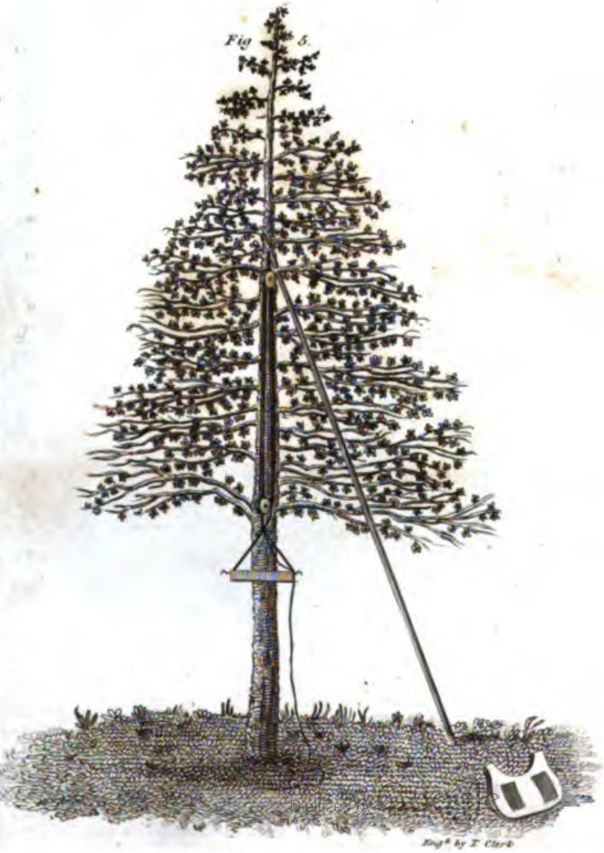

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Engd by T. Clark

PLATE III

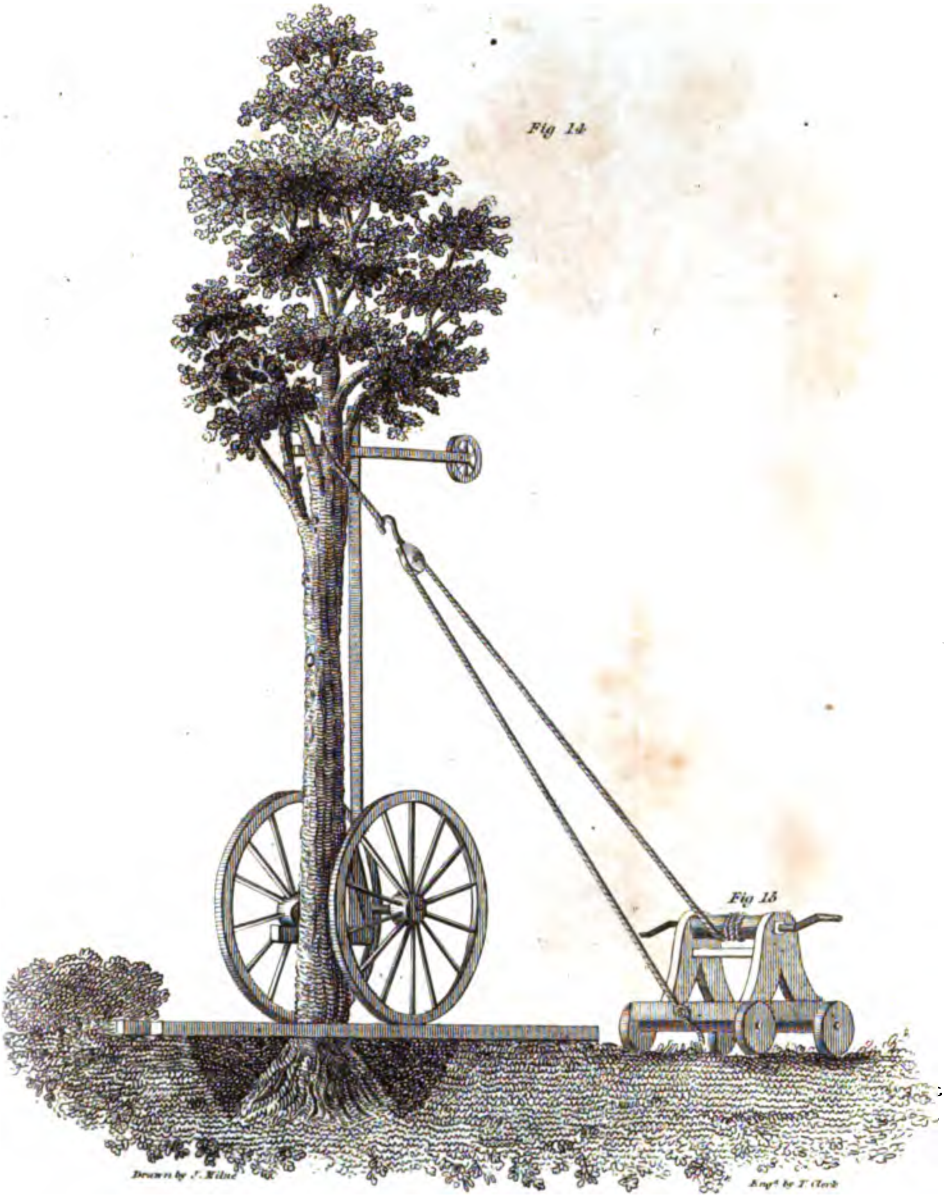

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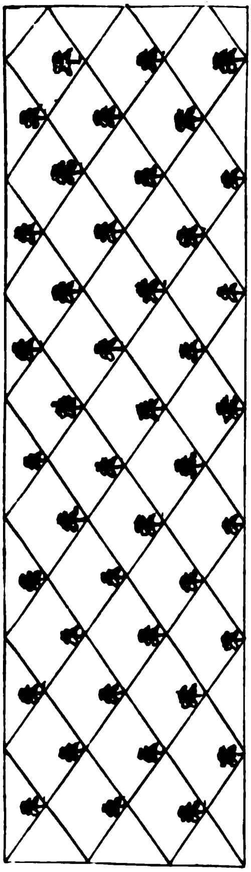
PLATE IIII

Fig 16



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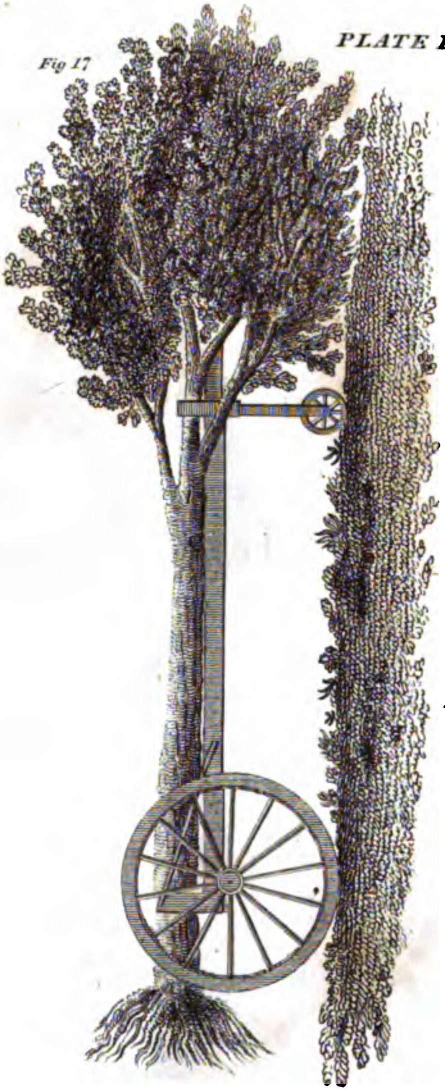

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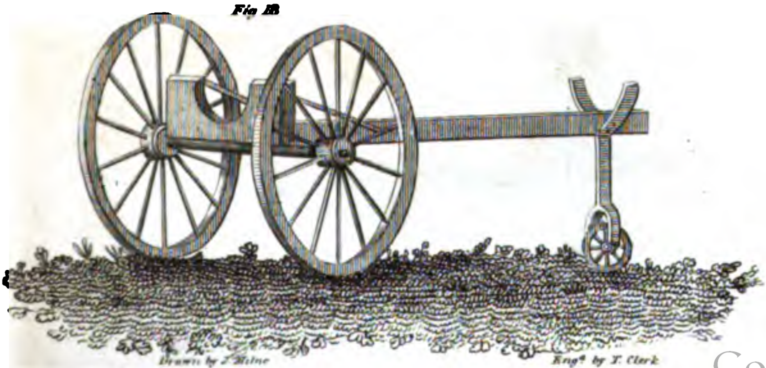

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Monteath's Newly Invented Machine for Measuring Growing Trees.

PLATE V

Fig. 19.

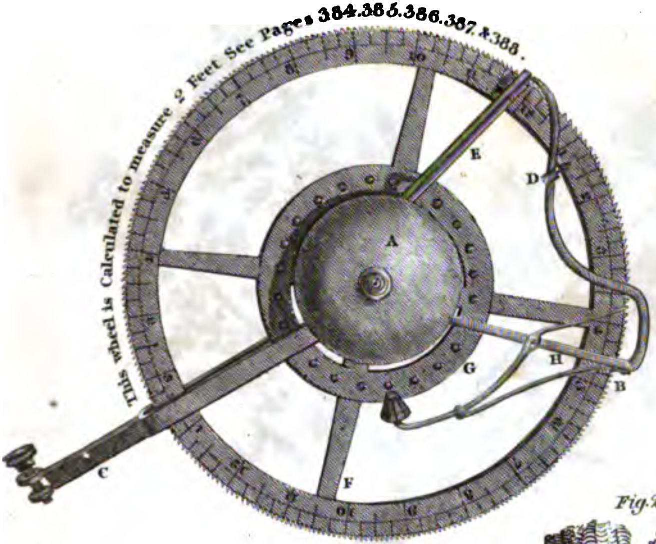
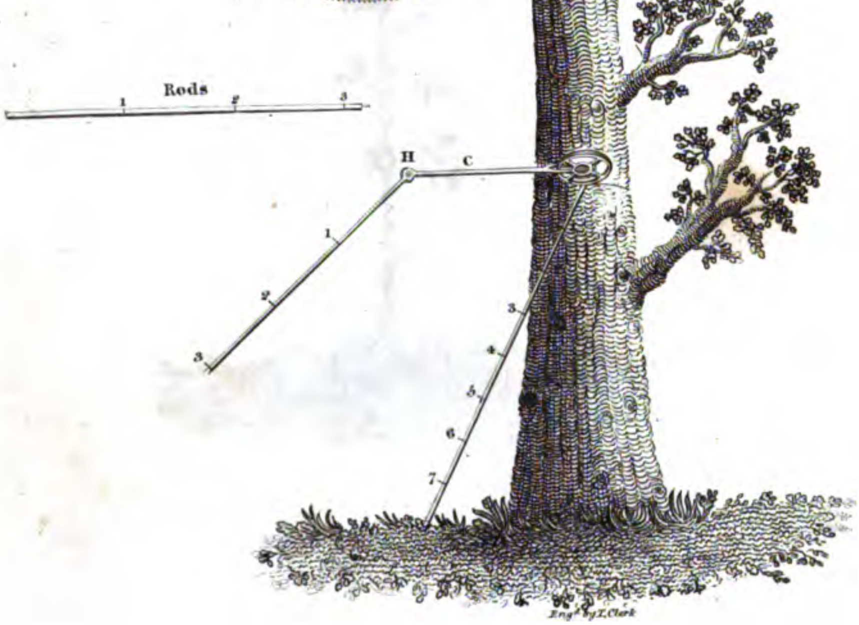

This wheel is Calculated to measure 2 Feet See Pages 384.385.386.387 & 388.
A
B
C
D
E
F
G
H

Fig. 20.



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Monteaths CONNECTING RODS for Measuring Growing Trees.

PLATE VI

Fig 21.

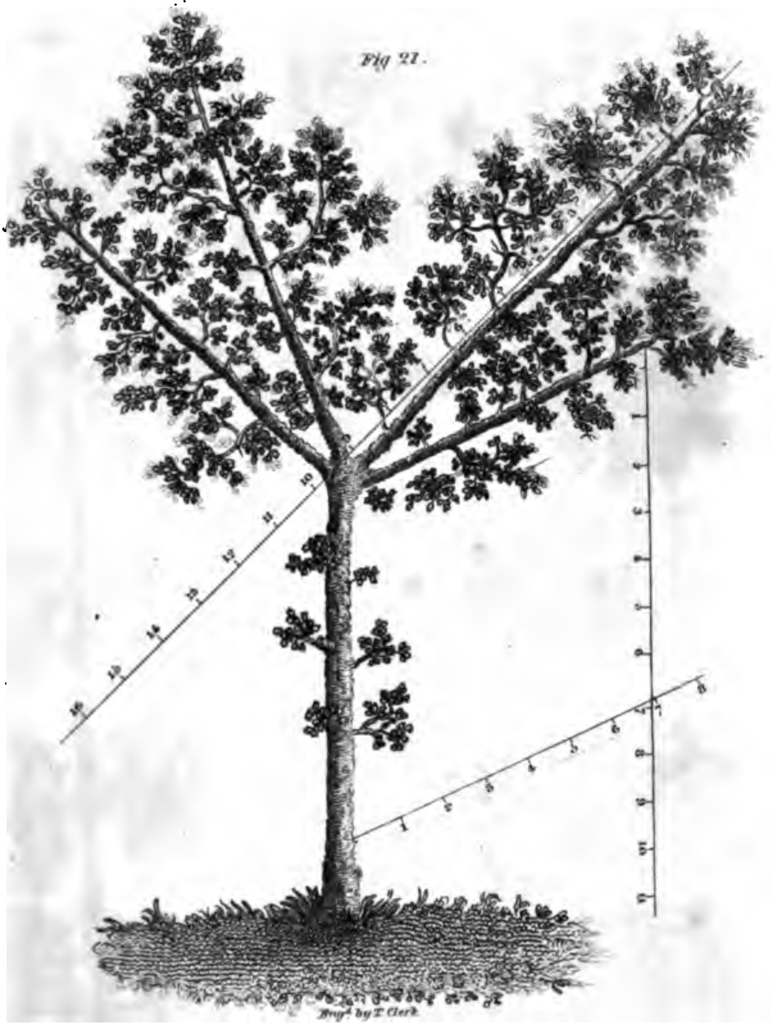

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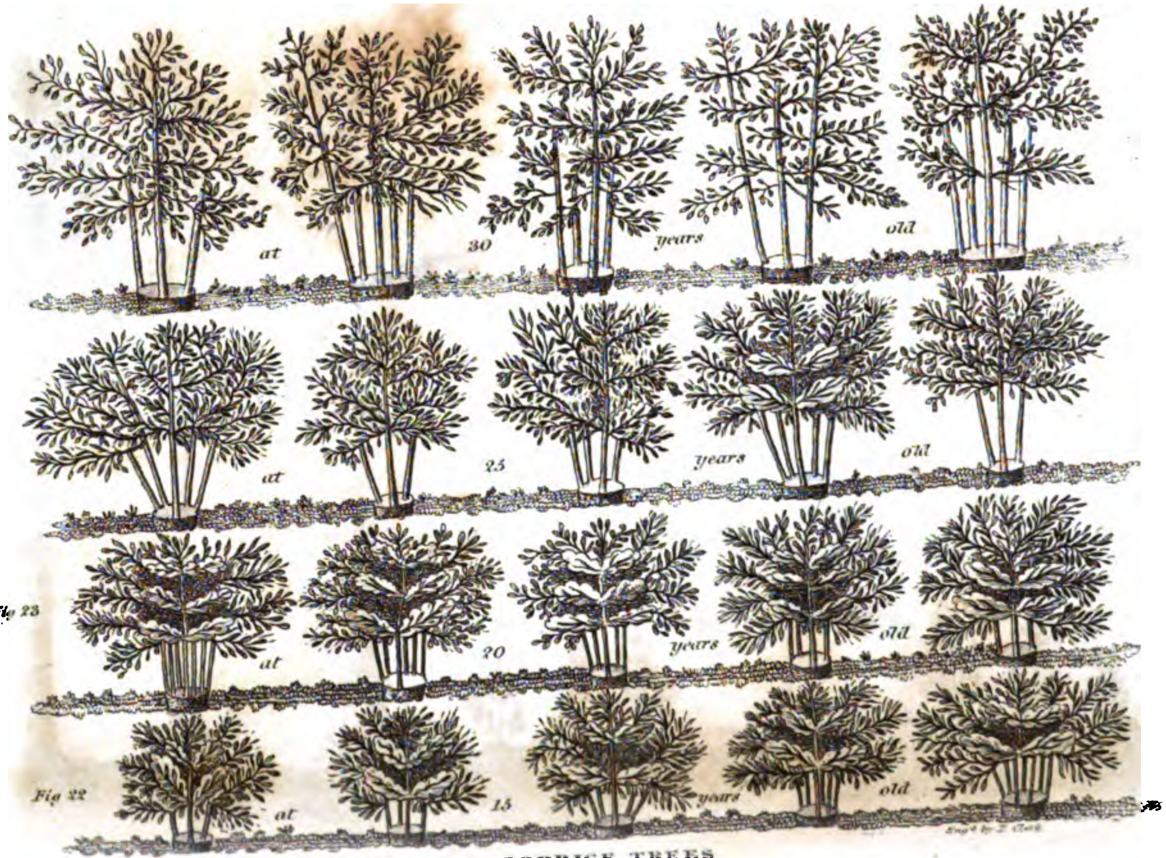
PLATE VII



COPPICE TREES

PLATE VIII

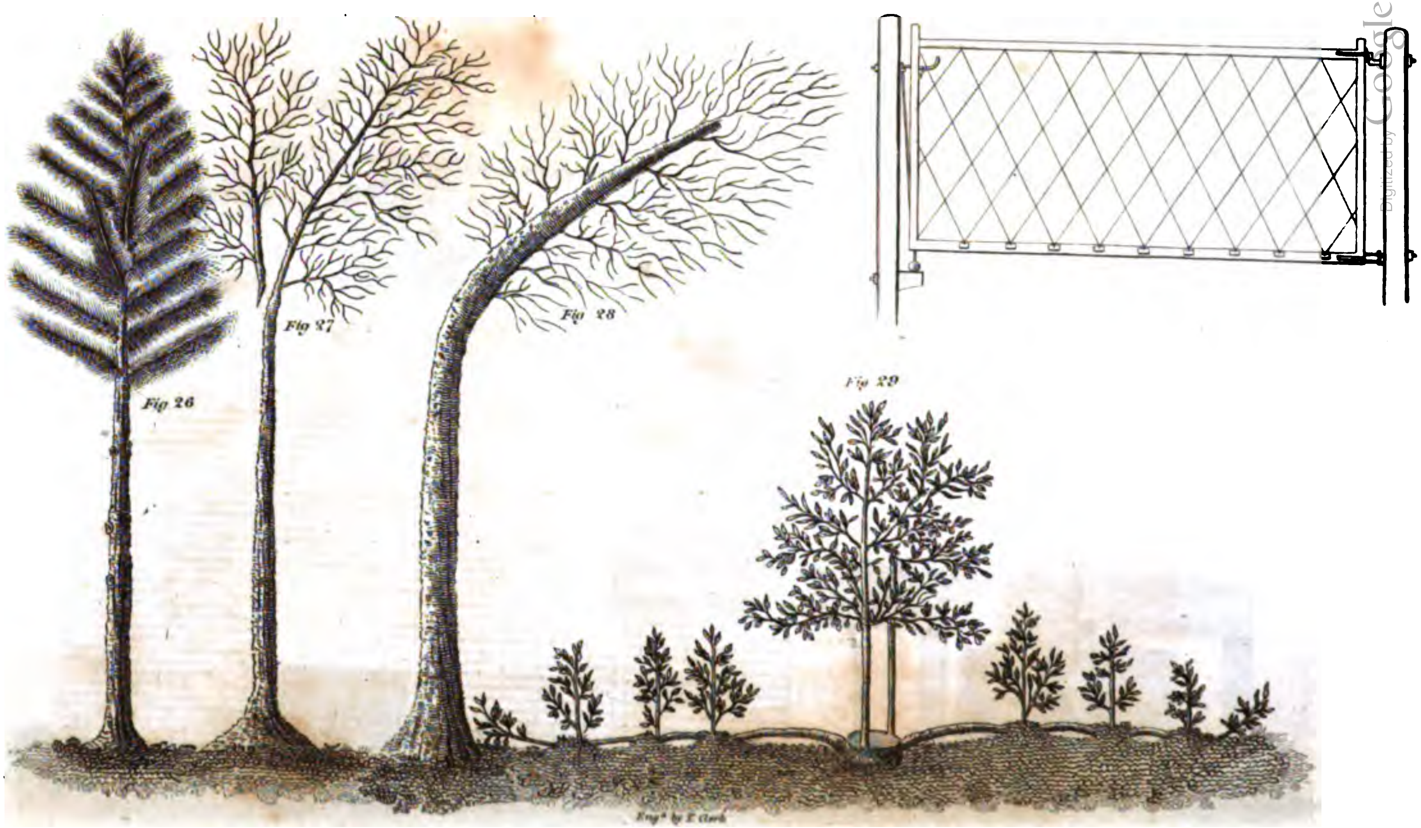


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PLATE IX

Fig 30

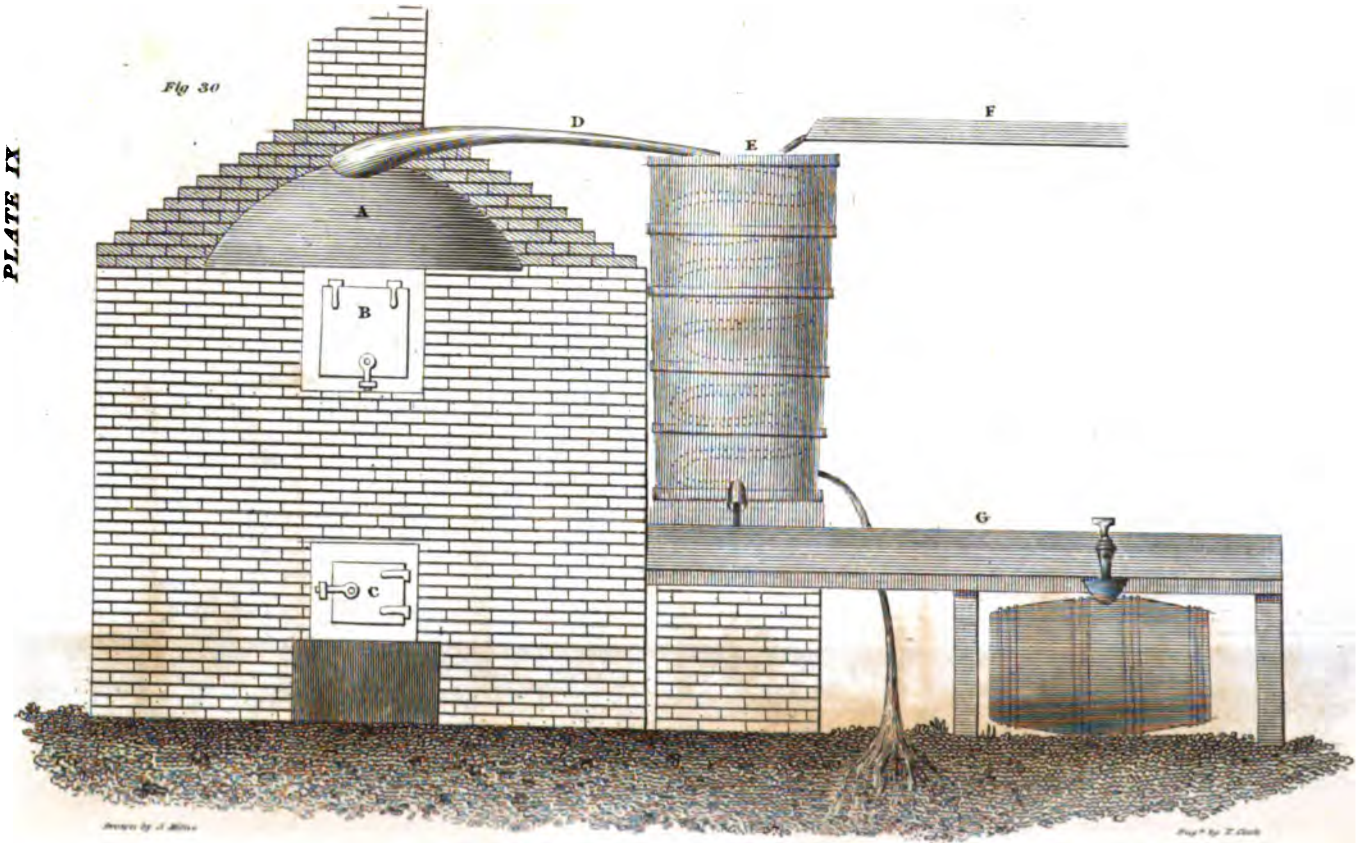

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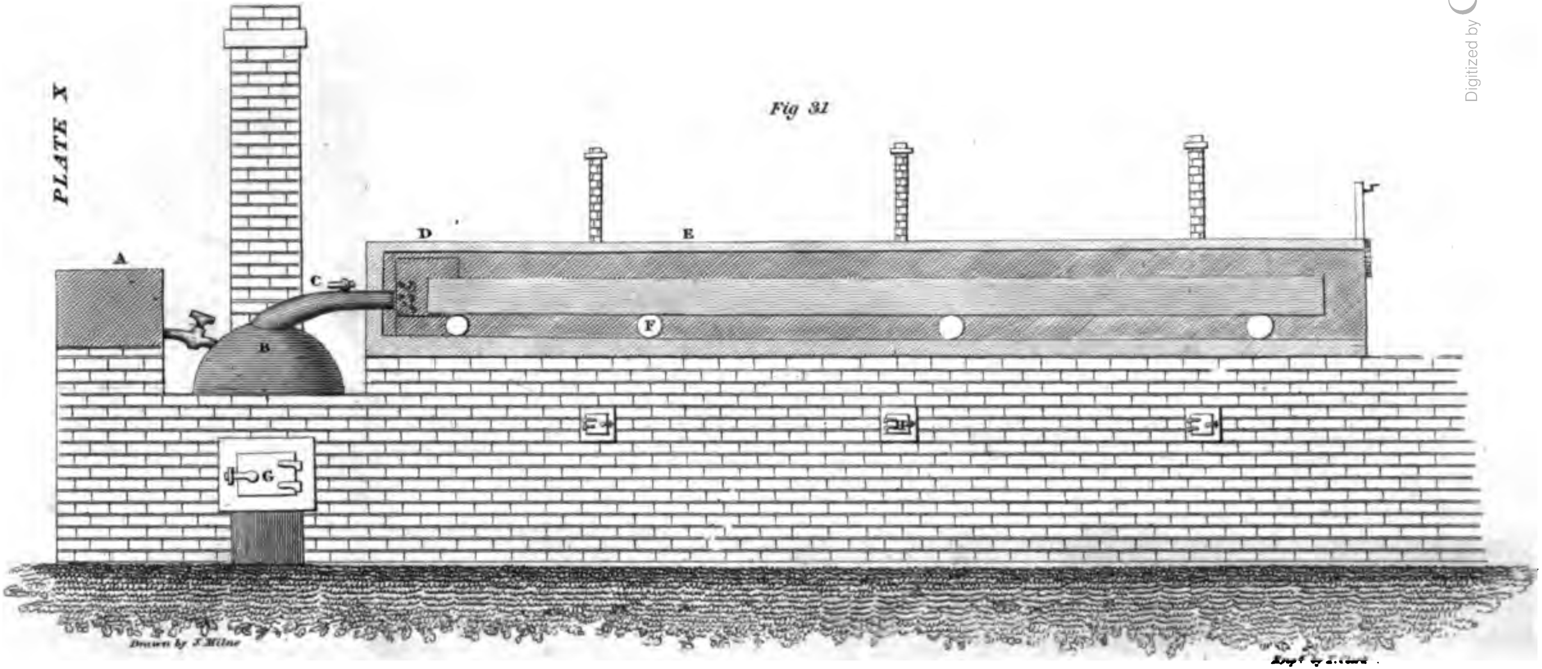
PLATE X

Fig 31



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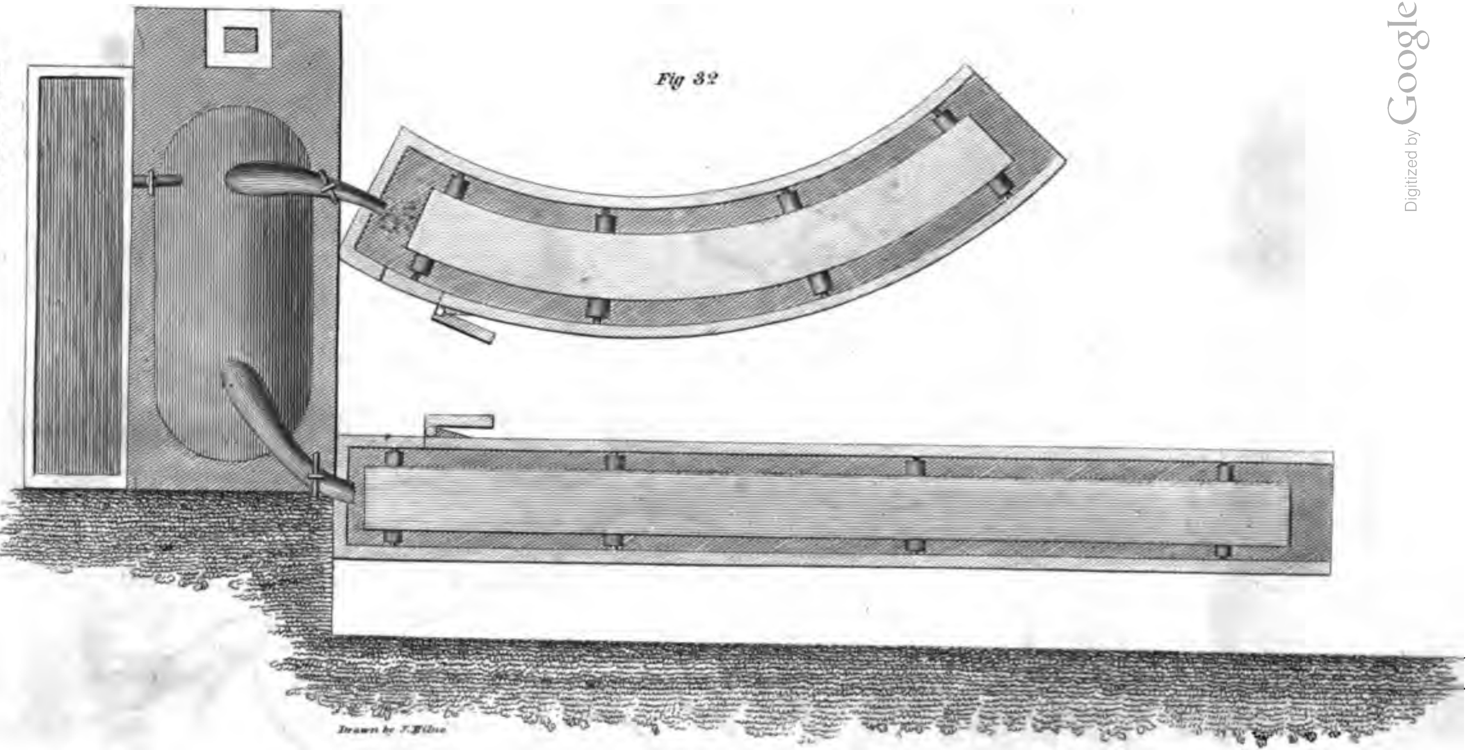
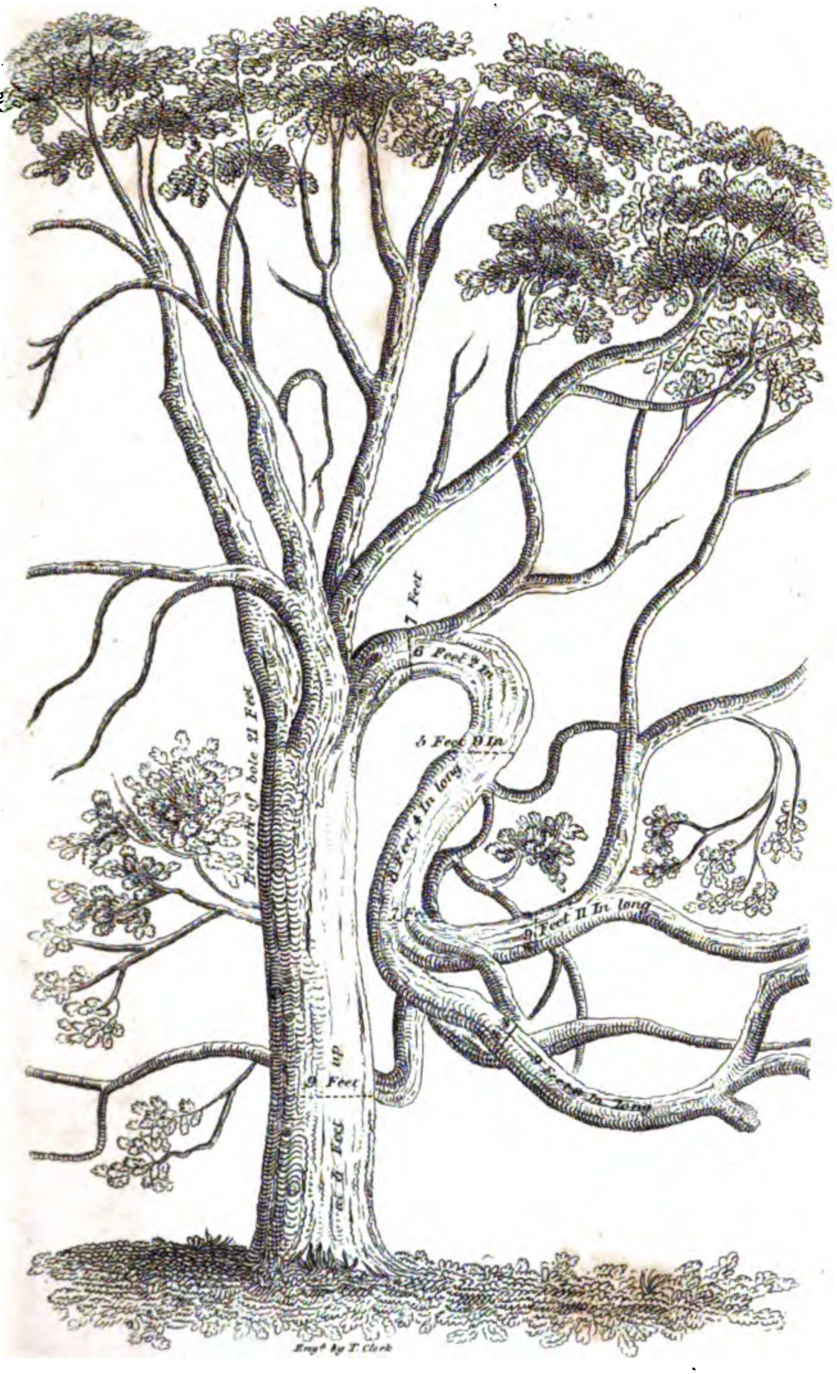


Fig 32

Drawn by J. Wilson

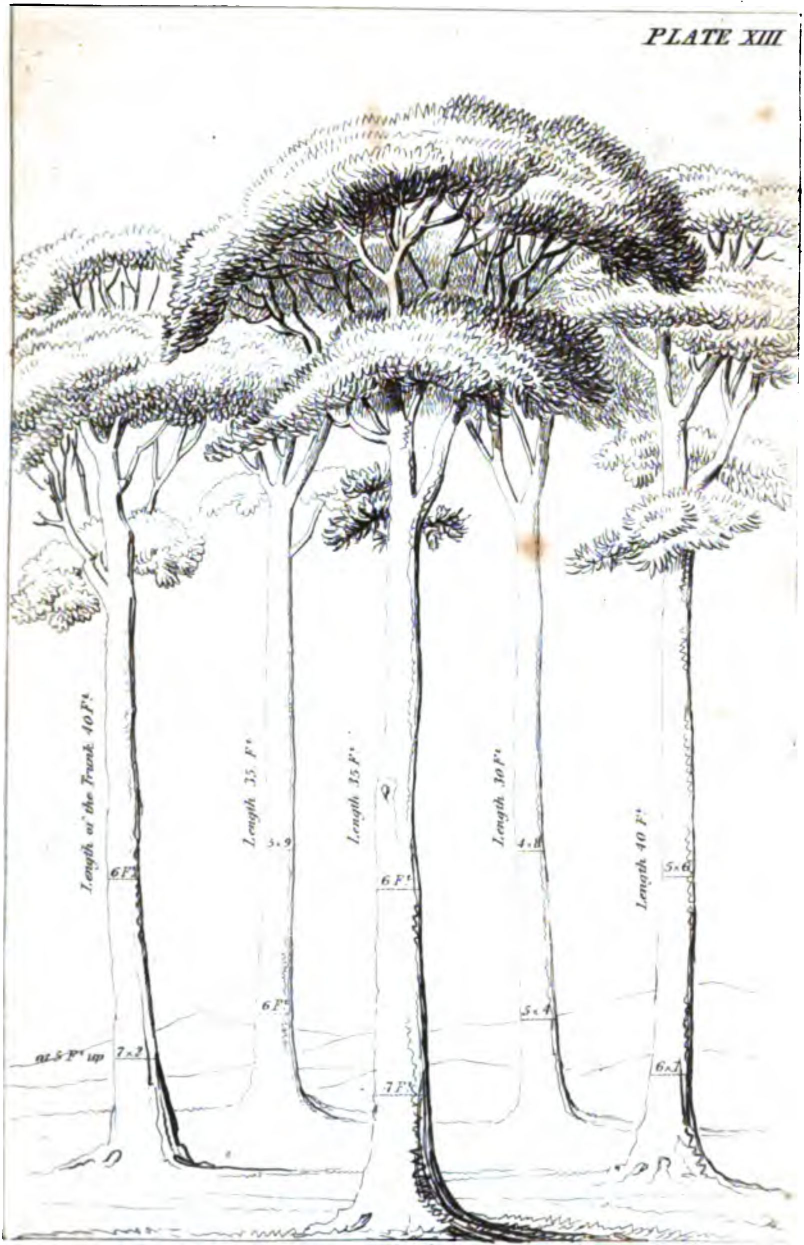
Eng^d by J Clark



Eng^d by T. Clerk

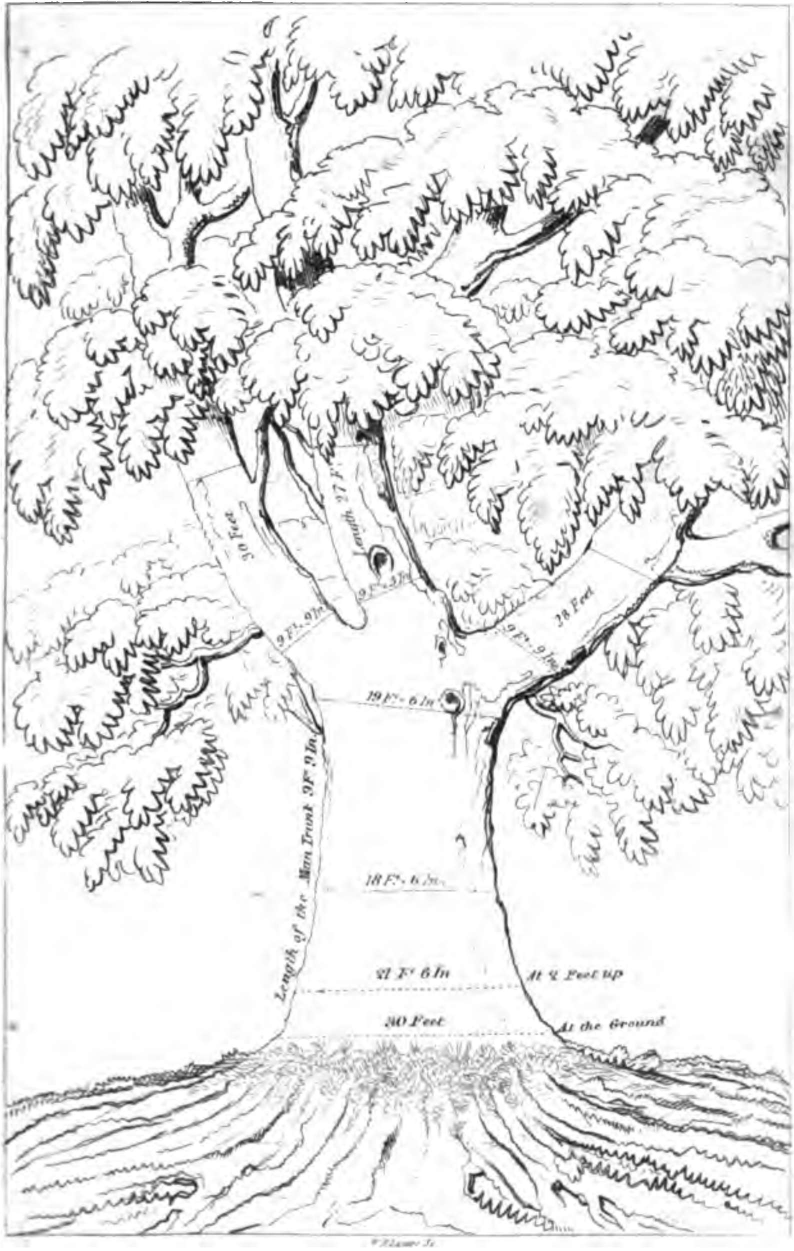
ELM on the Estate of TOUCH

PLATE XIII



FIVE SCOTCH FIR TREES ON THE ESTATE OF AIRTHREY.

The Property of Gen.l Sir Rob.t Abercromby K.G.C.B measured 29th May 1821 the whole stands within 44 Feet 6 Inches at Ground in circumference.


30 Feet
Length 27 Ft.
9 Ft. 3 In.
9 Ft. 9 In.
28 Feet
9 Ft. 9 In.
19 Ft. 6 In.
Length of the Main Trunk 9F. 9 In.
18 Ft. 6 In.
21 Ft. 6 In
At 2 Feet up
30 Feet
At the Ground

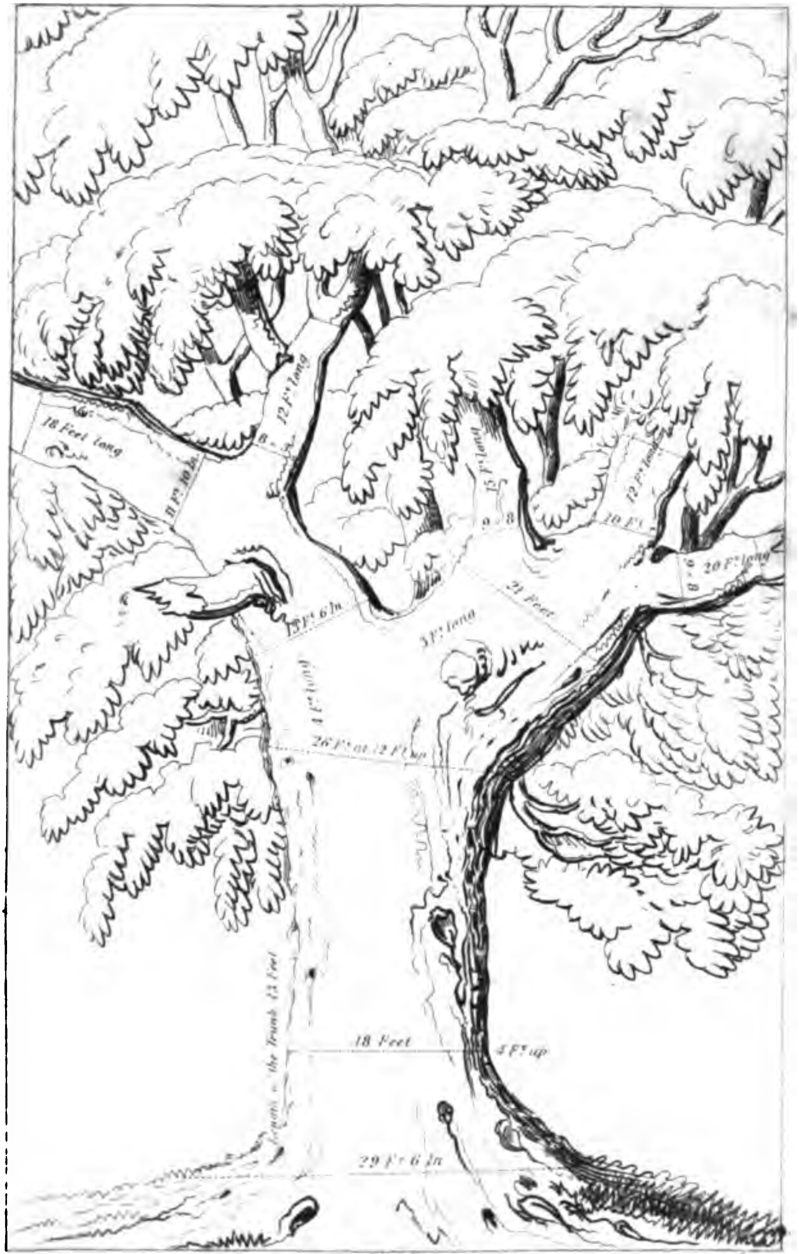
W. H. Lizars Sc.

ASH TREE AT CARNOCK HOUSE STIRLING SHIRE

The Property of M. S. Nicolson Esq.r & contains 679 Cubic Feet.

Measured with Monteath's newly Invented Machine 21st May 1821.

PLATE XV.

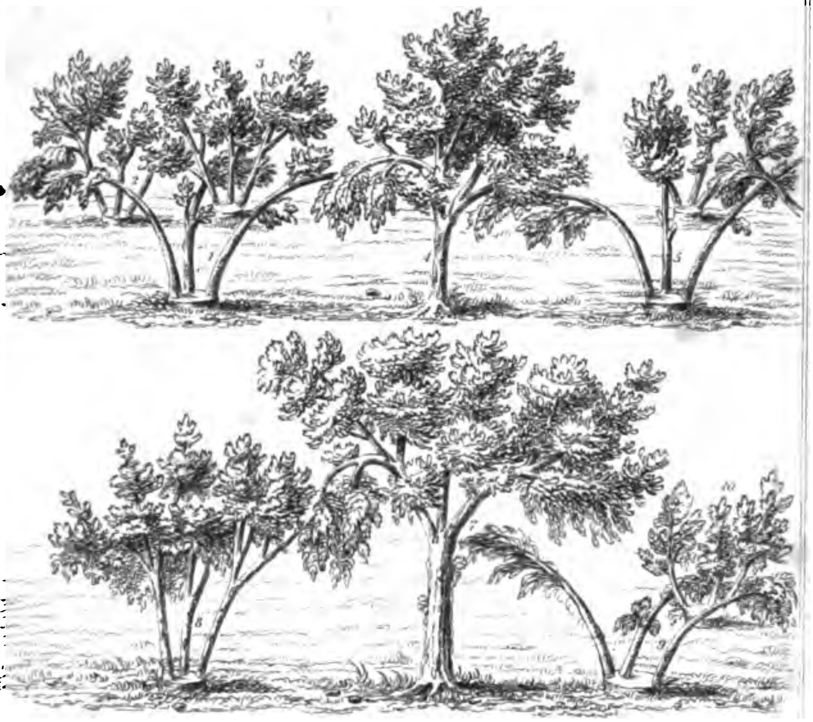


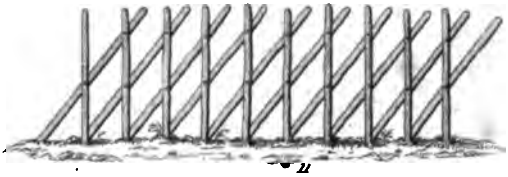
LARGE PLANETREE AT KIPPENROSS PERTH SHIRE.

The Property of John Stirling Esqr. measured the 29th May 1821 containing 875 Feet 2 Inches Cubic

The Circumference of Ground covered by its branches is 276 Feet

PLATE XVI.

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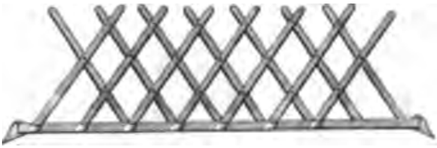
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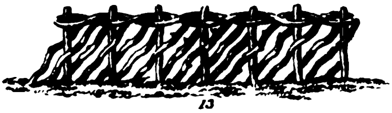
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INTRODUCTION.

The object which the Author in the first edition of the Forester's Guide had more immediately in view, in submitting its pages to the public, was to lay down rules, and to describe a method by which standing trees of all sizes may be accurately and expeditiously measured, and their exact value ascertained. Considering it also of great importance, in connexion with the subject, and as a thing entirely new and much wanted, to state the true method of valuing woods, plantations, and timber trees of all ages, and particularly oak coppice-woods and birch, he commenced the work with a few observations on the pruning, thinning, and training up of coppice-wood; to which was also added, the most general, as well as the best mode of cutting, dressing, and rearing up of natural oak woods: a thing also new and much wanted. The general approbation that this little work met with from the public, was a strong incitement to publish a second edition; and having obtained more extensive knowledge and experience of the subject, the author was induced to add a section on planting, in which will be found many things useful and new. In this third edition, as in the two former ones, the author is still guided more by his own experience than by theory, or by those who have trod the ground before him. Previous to the publication of the first edition, he had never read a single author on the subject. Where one or two are quoted, these were sent him by a friend. Since the first edition was published, he has consulted different authors, but must confess himself more bewildered than instructed; and, considering the extensive variety of his own experience, which he is enabled to lay before the public, in order to be as concise as possible, very few quotations will suffice. In the sequel, the author trusts it will be found that he has aimed more at being intelligible than elegant, more at being concise than verbose, which would only obscure his meaning. He makes no pretensions to literary knowledge—he advances what he conceives or knows to be facts—he is not guided in his opinions by theory, but proposes and recommends what is the result of many years experience.

He cannot forbear mentioning, that the planting and training up of woods to maturity, is an art as yet only in its infancy in Scotland; and, from still more extensive experience in his profession, is sorry to have to add to the account, England and Ireland, especially many counties of them, where there are many thousands of acres capable of bearing most excellent timber, and suited to no other purpose. He trusts, should these pages ever fall into the hands of those noblemen and gentlemen of his native country, who have land of the above description, and if they should chance to peruse it, after seeing, from the true statements which experience has enabled him to submit, the value of an acre of every kind of wood land properly trained up, that they will not consider such plantations merely as they may ornament and beautify their estates, but as the means also of immense revenue.

The cultivation of timber for the construction of ships, to enable this our sea-girt island to repel the invasion of foreign enemies, and maintain its dignified naval pre-eminence, is an object of the very last and greatest importance to Britain, which is every day more and more depending, under God, upon her navy for her salvation. He would recommend to those who are inclined to consider the rearing of plantations of timber trees, particularly oak, in the light of a national benefit, the perusal of the letter of the late Lord Melville to the late Mr. Percival, upon the subject of naval timber, published in July 1810. Coming from the pen of a writer so able, a statesman so profound, dictated by a judgment so correct, and a knowledge of the subject so extensive, it cannot fail to show that it is, and always will be, the soundest policy, to have as abundant a supply as possible of native British oak woods.

If the following document regarding the government forests in Essex be not long ago remedied, it is a shameful neglect, and a ground of grievous lamentation. "On a survey of the timber in the king's woods in Essex," says Mr. Young, "it was found that the whole number of oak trees, from ten feet upwards, was 11,055. Of these, 2760 were reported to be trees of thirty feet and upwards, and to be fit for the use of the navy; 7825 were young trees, from thirty feet down to ten feet each, and the rest scrabbed and unthrifty. On the whole, the number of oaks was less than four trees to the acre; and of those thirty feet and upwards, less than one tree to the acre." * What a dreadful deficiency of a crop! This land, capable of carrying fifty trees on the acre to 100 years old, which should be worth at least L.25 per tree, or L.1250 per acre, according to the above statement is not worth L.10. We

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* See Young's Agriculture of Essex, and Annual Review.

hope, however, that the crown forests are now much better attended to; although it appears, from a publication so late as 1820, they are not in the state of improvement that they should be. The alarming decrease of oak timber in this country is universally acknowledged and lamented; and it has become an important desideratum to every man who wishes for the preservation and independence of his country, that some active and efficient legislative measure should be immediately adopted, to avert the impending evil that must inevitably take place. It is said that Britain is going to build ships of war of mahogany; but those who are acquainted with the nature of mahogany, will tremble for the safety of our gallant seamen, when they are necessitated to face the enemy in mahogany ships, where the splinters from one shot will kill more than ten bullets. But granting there was not such great need, as we have been arguing, for timber for the navy, might not these forests be turned to great advantage, and bring in a very great revenue, by supplying the country demand? as it will be clearly shown in the following pages of this work, that land not fit for carrying any other kind of crop, can, by proper attention and management, pay at the rate of from five to ten pounds Sterling per acre, of annual rent, counting interest and compound interest, &c. But, to carry the matter a little farther, were our foreign supplies of timber cut off by a war for ten years only, the whole country would not afford a five years supply of full-grown timber; and, if my information be correct, there is not as much full-grown timber at present, in all the national forests, (from their neglected state,) as would replace, or fit out a navy as it stood in 1810. In the present state of agricultural distress, were government to adopt the following plan, it would not only enrich, and make up their exhausted funds, but keep the nation always independent, beautify the country, enrich the exhausted landholders, completely relieve the distressed agriculturist, and give employment to thousands of half-starving labourers. Supposing the government to become feuars or tenants to a number of the landholders in Scotland, England, and Ireland, particularly to those whose lands hold a local situation to the sea; suppose, in Scotland, Argyle, Ross, Inverness, Aberdeen, and Forfarshire; in most of which there are a great number of acres that would carry fine timber to maturity, and which are fit for nothing else, that could be got for ten shillings per acre, and suppose them planted and converted into forests, they would, with proper management, even during their minority, pay the expense of annual rent by their thinnings; and, by laying a little more duty on the importation of foreign barks, these forests, at twenty-four years old, and for ever after, will bring in a clear annual profit of at least four pounds Sterling per acre, even in times of profound peace; besides the great advantage of keeping always an abundant supply of naval oak timber. France has, in her public forests, a source of revenue which is altogether unknown in this country. Under the old government, these forests covered three millions of acres, and yielded annually a produce of half a million Sterling—wood being the principal fuel; but since the revolution, the annexation of emigrant, and other property, has increased their extent to five millions of acres, and their revenue to nearly three millions Sterling per annum. Above eight thousand persons are employed in taking charge of these forests, and nearly four times that number are working constantly in them; by which means the French government has always a supply of timber.*

In many parts in England and Ireland, and also in the shires of Aberdeen, Forfar, Inverness, Ross, and Argyle, in Scotland, there are vast tracts of land well calculated for the purpose of rearing timber, situations rendered still more eligible by their local advantage of easy sea carriage, as already alluded to. These considerations should hold out inducements to the landholders of these extensive districts, to plant infinitely more than, for several years, they have been in the habit of doing; more especially, when connected with this consideration, that they would yield a vast deal more when laid out in timber, than if they had been laid out for any other purposes of agriculture.

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* Since the Second Edition of the Forester's Guide was published, I have sent, (at the request of the proprietors,) several foresters to France, from whom I have received some more information as to the management of their forests, which, I trust, will not be uninteresting to my readers, and which will be found in its proper place in this edition.

The objection urged against planting is, that the present proprietor or planter will derive no benefit from his labour and expense, that the profits being distant, hold out no inducement to speculators: but in the sequel it will be seen that the planter will obtain very considerable advantage from so doing. But, granting that the planter does not derive any personal benefit immediately from the woods, the estate is by so much the more valuable, in proportion to the quantity planted. To confute the old, as well as new, argument, of profits from planting being so distant as to hold out no encouragement to individual proprietors to plant, take the following statement of facts, (besides what will be found in the sequel,) taken from actual measurement. There is at present, on the estate of Inverary, the property of the Duke of Argyle, a plantation of larch firs only sixteen years old, bearing 1000 trees on each acre; every tree is well worth, and would sell, at the present time, (taking into consideration the reduced price of timber,) at four shillings, being L.200 Sterling the acre, which, after deducting the expense of planting, and allowing a fair rent for the land, with interest and compound interest, will yield at least L.8 an acre of annual rent; the thinnings having paid more than the expenses of fencing the plantations, &c. Here we have a return, and an amazing profit, in sixteen years. There is on the same estate, a silver fir tree, seventy years old this spring, girthing ten feet, containing upwards of 300 solid feet; there are hundreds of trees the same age, and nearly the same size, on the same estate. An acre of land will easily carry sixty such trees; which, at the low price of two shillings per foot, will amount to L.1800 an acre. There is also on the estate of Airthrey, in Stirlingshire, the property of Sir Robert Abercromby, a plantation of ash trees, only fifty-nine years old, averaging 600 trees on an acre, and many of these trees have upwards of sixty feet of a bole without either knot or branch, girthing four feet, the average solid measure of the whole being thirty-two feet each tree; which, at two and sixpence per foot, (a low price for such trees,) is L.4 per tree, being no less than L.2400 per acre; and I am well informed that the thinnings of these ash trees have paid a fair rent for the land ever since they were fifteen years old. These trees underwent a slender thinning two years ago, but can still be seen on the estates. What an immense sum for the crop of one acre! Who will dare to affirm that plantations are not worth care or attention in rearing, even laying ornament and shelter aside?

As to the quickness of rearing plantations, take the following example, amongst many that could be given, which can be well attested: There was a general thinning of the plantations referred to on the estate of Airthrey in spring, 1822, and from the manner in which the stools of the oak, ash, elm, plane, and Spanish chesnut were dressed up, they sent out young shoots with such rapidity, that thousands of them measured, in the month of September following, only about five months growth, six, seven, and eight feet, and some particular shoots ten feet long; and many of them girthed three inches at the root. This, of course, must be the surest, speediest, and most effectual method of rearing plantations; but more of this under the section Coppice Woods, cut every twenty or twenty-four years.

The following table of the actual measurement of twelve trees showing their rapid increase in size is a most convincing and stubborn proof of the foregoing facts. The trees referred to are still on the ground on the different estates, and can be seen.

TABLE showing the Increase of Twelve Trees in Sixteen Years, from actual measurements, taken first in April 1800, *before they began to grow, and again in autumn* 1816, *after that year's growth was complete.*

Different sorts of Trees measured.	*Girth in* 1800.			*Girth in* 1816.			*Height in* 1800.	*Height in* 1816.	*Solid contents* 1800.	*Solid contents* 1816.	*Increase* 16 *years.*
	Feet.	Inches.	Parts.	Feet.	Inches.	Parts.	Feet.	Feet.	Cubic Feet.	Cubic Feet.	Cubic Feet.
No. 1. An Ash, ...	9	10	4	11	1	0	29¾	30½	172.9	230.6	57.7
2. An Oak, . . .	9	4	4	10	1	0	29½	30	149.3	190.3	41.0
3. An Oak, about eighty years old, .	6	3	3	7	8	3	27½	28¾	67.5	118.0	50.5
4. A Scotch Fir, ...	5	4	6	6	6	0	26	27¾	46.2	72.9	26.7
5. A Spanish Chesnut, near sixty years old,	4	4	0	5	6	3	23½	26¼	27.5	51.6	24.1
6. An Oak, planted about sixty years ago,	5	11	1	7	2	3	26¾	28¾	57.1	91.9	34.8
7. A Spanish Chesnut, forty-five years old,	2	9	6	4	4	4	18	23½	8.4	27.5	19.1
8. An Oak, . . .	2	11	2	5	1	2	18	23¼	9.5	37.9	28.4
9. A Scotch Fir, ...	1	11	6	4	0	0	15	23	3.7	23.0	19.3
10. A pinaster, . . .	2	5	1	4	3	1	17	28½	6.4	26.5	20.1
11. An Oak, . . .	1	7	0	2	8	2	13	18	2	7.9	5.9
12. An Oak, . . .	1	9	5	4	9	4	18	25	8.7	35.2	26.5
Total increase in sixteen years, ...											353.3

From this table, it appears that twelve trees increased three hundred and fifty-three cubic feet in sixteen years, which, if sold at the low price of one shilling per cubic foot, would amount to L.17, 13s. Sterling. Now, if we suppose a Scotch acre of ground planted with trees, at ten feet distance from one another, it would contain upwards of 540 trees, and would, thriving at the same rate, yield an increase of 15,885 cubic feet in sixteen years, which, if sold at one shilling per foot, would amount to somewhat more than L.794 Sterling, which, divided by sixteen, gives L.49, 10s. for the annual produce of one acre.

As a still farther proof of this, the reader is presented with the following

STATEMENT:

If the proprietor, for instance, plants 100 acres of ground, the trees being placed four feet distant from each other, each acre will contain 3422 plants; and if it is planted with hard woods, especially oaks, and a few firs to nurse them up, supposing it is a plantation intended solely for profit, the expense of plants and planting per acre will be £6, -	£600	0	0
Rent of land for 10 years, at £1 per acre per annum,[*] - - - - - -	1000	0	0
Carry Forward,	£1600	0	0

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[*] It will not be disputed, that there are thousands of acres of land capable of bearing excellent timber, that are not worth 10s.

Brought Forward,				£1600	0	0
Interest on the rent, - - -				225	0	0
Expenses of thinning, pruning, and training up, for 10 years, at £1 per acre per annum,				1000	0	0
Total expenditure, -				£2825	0	0
Deduct produce of 1000 trees thinned from each acre during the first ten years, at £2 per acre, - - -	£200	0	0			
Deduct value of 2422 trees left on the ground after the first 10 years, at £7, 10s. per acre, -	750	0	0			
				950	0	0
Total outlay at the end of ten years,				£1875	0	0
To which add expense of thinning and pruning for the next 10 years, at £2 per acre, - -	£200	0	0			
Rent of the land for the same period, at £1 per acre per annum,	1000	0	0			
Interest on the rent for the same period, - -	275	0	0			
Interest on £1875 for 10 years,	937	0	0			
				2412	10	0
Total outlay for 20 years, -				£4287	10	0
Deduct produce of 1000 trees thinned out during the last 10 years, from each acre, which will, at the lowest, bring 6d. each, or £25 per acre, - -	2500	0	0			
Carried Forward,	£2500	0	0	4287	10	0

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per acre to the proprietors; and that, therefore, the rent of land is here perhaps exaggerated.

Brought Forward,	£2500	0	0	4287	10	0
Deduct for 1422 trees which fall to be enhanced in value during the last ten years, and will come to, at least, £35, 11s. per acre,	3555	0	0			
				6055	0	0
				£1767	10	0
Deduct from this the value of these 1000 trees as they were estimated at the end of the first 10 years, at £3, 2s. per acre, - -				310	0	0
Thus leaving a balance in favour, of -				£1457	10	0

We have now value on the ground of L.14, 10s. each acre, at the end of twenty years, which is L.1457, 10s. after allowing for every expense. We shall now extend the calculations to a further period.

Rent of other 10 years, at £1 per acre, per annum, -	£1000	0	0			
Interest on the rent, -	£75	0	0			
Expense of thinning out 500 trees, and pruning, &c. &c. at £3 per acre, - -	300	0	0			
				1575	0	0
Value of 500 trees, which, being now 30 years old, bring at least 3s. per tree, or £75 per acre,	7500	0	0			
Interest on £2500, for 10 years,	1250	0	0			
				8750	0	0
Carry Forward				£7175	0	0

Brought Forward,	£7175	0	0
Deduct from this the value of 500 trees per acre, as they were estimated at the end of 20 years, about £11, - - -	1100	0	0
	6075	0	0
Add balance in favour at the end of 20 years,	1457	10	0
But there are still 922 trees on each acre, each of which is worth at least 3s. 6d. or £161, 7s. per acre, - - - -	16,135	0	0
Total in favour at the end of 30 years, -	23,667	10	0

We shall now extend the calculation for ten years more.

Rent for other ten years at £1 per acre, per annum, -	£1000	0	0			
Interest on the rent, -	275	0	0			
Expense of thinning out 422 trees per acre, at £4 per acre, -	400	0	0			
But there are still too many trees on the ground to be nursed up to maturity, suppose, therefore, that 422 trees are thinned out from each acre, the value of each will be, at least, when they have now attained the age of 40 years, 4s. 6d. each, or £94, 19s. per acre,	£9495	0	0			
Interest on £7500, and on £2500, for 10 years, - -	5000	0	0	14,495	0	0
But deduct the value of 422 trees, at the rate at which they were estimated, at the end of 30 years, 3s. 6d. each, - -	7385	0	0	7,110	0	0
				£5,435	0	0

Brought Forward,	£5,435	0	0
Add balance in favour, at the end of 30 years,	23,667	10	0
There are still 500 trees on each acre, each of which is now worth at least 5s. or £125 per acre, - - -	12,500	0	0
	41,602	10	0
Suppose an expense is incurred in incidental expenses, such as sale, &c. of * - -	602	10	0
A balance is left in favour of the proprietor at the end of 40 years, of - -	£41,000	0	0

Thus, the value of the wood on each acre, the wood having attained the age of forty years, is L.410; supposing the whole were to be cut down even at this age, the profit would be immense. These calculations may, to those who have paid no attention to the subject, excite wonder if not doubt; but, in making them, the author has been careful rather to lessen than to exaggerate the profits. It is surely no uncommon thing to see a tree at forty years of age worth 7s. 6d. but much oftener worth L. 1, 15s., and if an oak or Spanish chesnut,

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[*] It will be seen by any unprejudiced person, that I have estimated the expenditure at more than what will do it at the present day; and I have no hesitation in saying, that were I to live for forty years longer, I would undertake to rear up for any gentleman, and give him, on a hundred acres of land, where he is perhaps not receiving 10s. per acre, the full value here stated, without any additional charge of expenditure.

often worth L.3 Sterling, and it is no uncommon thing to see a plantation at that age bearing more than 500 trees per acre, which is a distance of ten feet between each, worth that sum.

But if the plantation shall have been carried to the age of sixty or seventy years, and properly thinned, &c. the value will be double what it was at forty years. The author begs to be understood, that he does not mean the thinnings to be made only at the end of every ten years:—this, besides the disadvantages of bringing too much wood into the market at once, ought to be done gradually and regularly. The manner of doing it is laid down in Section II. of this work. From the above calculations, it will be seen, that if an estate is to be left to the family of the proprietor, he benefits his posterity as much by planting 100 acres of wood as by adding 500 acres of good land to the estate. And if the estate is to be sold, the value of the wood will enhance the value of the estate in proportion.

I have known proprietors who have received the profits of three several cuttings of natural oak woods, when they have been cut every twenty-four years, or from twenty to thirty years, so that a young proprietor entering upon an estate at the age of twenty-one, and enjoying life to a tolerably old age, may derive great advantage from planting and training natural oak woods for coppices, or oak, or even any other wood, to maturity. Many other advantages might be enumerated as resulting from the planting and rearing of timber; but this subject has been treated of by persons far better fitted for the task.

I have received from the ingenious author, Wm. Withers, Esq. Holt, Norfolk, his very interesting and valuable practical memoir on the planting and rearing of forest trees, published 1827. An extract or two from it will be found on the section on planting.

As that memoir may not have fallen into the hands of many of my Scotch readers, I consider it of importance to add the following valuable tables by Mr. Waistell, for ascertaining the progressive annual increase in the growth of trees at every period of 4 years from 12 to 64 years, the rate per cent. they pay in the several periods of their growth, and other interesting particulars.

MR. WAISTELL'S TABLES RESPECTING THE GROWTH OF TIMBER.

Published in the 26th volume of the Transactions of the Society of Arts.

"CALCULATIONS, showing every fourth year from twelve to one hundred, the progressive annual increase in the growth of trees, and gradual decrease in the rate per cent. per annum, that the annual increase bears to the whole tree.

" The whole height of the trees is taken to the top of the leading shoot, and the girt in the middle; but no account is taken of the lateral branches.

" If trees increase twelve inches in height, and one in circumference annually, their increase wil be as under-mentioned viz.

TABLE. I.

Years old & ft. high.	Girt.	Contents.			Years old & ft. high.	Girt.	Contents.				One year's increase.				Rate per cent. of increase.
	inch.	ft.	in.	pts.		inch.	ft.	in.	pts.	sds.	ft.	in.	pts.	sds.	
12	1½	0	2	3	13	1⅝	0	2	10	3	0	0	7	3	26.8
16	2	0	5	4	17	2⅛	0	6	4	9	0	1	0	9	19.9
20	2½	0	10	5	21	2⅝	1	0	0	8	0	1	7	8	15.7
24	3	1	6	0	25	3⅛	1	8	4	1	0	2	4	1	13
28	3½	2	4	7	29	3⅝	2	7	9	1	0	3	2	0	11
32	4	3	6	8	33	4⅛	3	10	9	6	0	4	1	6	9.67
36	4½	5	0	9	37	4⅝	5	5	11	5	0	5	2	5	8.5
40	5	6	11	4	41	5⅛	7	5	8	10	0	6	4	10	7.6
44	5½	9	2	11	45	5⅝	9	10	7	9	0	7	8	9	6.96
48	6	12	0	0	49	6⅛	12	9	2	3	0	9	2	3	6.38
52	6½	15	3	0	53	6⅝	16	1	10	2	0	10	10	2	5.9
56	7	19	0	8	57	7⅛	20	1	1	7	1	0	5	7	5.4
60	7½	23	5	2	61	7⅝	24	7	6	6	1	2	4	6	5.1
64	8	28	5	4	65	8⅛	29	9	7	0	1	4	3	0	4.76
68	8½	34	1	4	69	8⅝	35	7	8	11	1	6	4	11	4.49
72	9	40	6	0	73	9⅛	42	2	6	4	1	8	6	4	4.2
76	9½	47	7	6	77	9⅝	49	6	5	2	1	10	11	2	3.98
80	10	55	6	8	81	10⅛	57	7	11	9	2	1	3	9	3.79
84	10½	64	3	8	85	10⅝	66	7	7	8	2	3	11	8	3.6
88	11	73	10	4	89	11⅛	76	5	11	1	2	7	7	1	3.5
92	11½	84	5	9	93	11⅝	87	3	4	0	2	9	7	0	3.3
96	12	96	0	0	97	12⅛	99	0	4	6	3	0	4	6	3.15
100	12½	108	6	0	101	12⅝	111	9	6	8	3	3		8	3

"If trees increase eighteen inches in height, and two inches in circumference, annually, their increase will be as under-mentioned, viz.

TABLE II.

Age of Trees.	Height.	Girt.	Contents.			Age of Trees.	Height	Girt.	Contents.				One year's increase.				Rate per cent. of increase.
	ft.	in.	ft.	in.	pt.		feet.	in.	ft.	in.	pt.	sd.	ft.	in.	pt.	sd.	
12	18	3	1	1	6	13	19½	3¼	1	5	1	0	0	3	7	0	26.5
16	24	4	2	8	0	17	25½	4¼	3	2	4	0	0	6	4	0	19.8
20	30	5	5	2	6	21	31½	5¼	6	0	3	6	0	9	9	6	15.6
24	36	6	9	0	0	25	37½	6¼	10	2	0	6	1	2	0	6	13
28	42	7	14	3	6	29	43½	7¼	15	10	6	0	1	7	0	0	11
32	48	8	21	4	0	33	49½	8¼	23	4	8	0	2	0	8	0	9.6
36	54	9	30	4	6	37	55½	9¼	32	11	7	6	2	7	1	6	8.5
40	60	10	41	8	0	41	61½	10¼	44	10	3	6	3	2	3	6	7.6
44	66	11	55	5	6	45	67½	11¼	59	3	10	0	3	10	4	0	6.9
48	72	12	72	0	0	49	73½	12¼	76	7	1	0	4	7	1	0	6.3
52	78	13	91	6	6	53	79½	13¼	96	10	11	6	5	4	5	6	5.8
56	84	14	114	4	0	57	85½	14¼	120	6	8	6	6	2	8	6	5.4
60	90	15	140	7	6	61	91½	15¼	147	9	2	0	7	1	8	0	5
64	96	16	170	8	0	65	97½	16¼	178	9	4	0	8	1	4	0	4.7

Mr. Waistell's Explanation of the Construction of Tables I. and II.

"To render the preceding tables easy to be understood by persons not accustomed to calculations, I will state the process of the operations in the first line of Table II.

"The height of trees at twelve years of age is supposed to be eighteen feet to the top of the leading shoot, and twenty-four inches in circumference at the ground, consequently, at half the height, the circumference is twelve inches; one-fourth of this, being three inches, is called the girt. The girt, being squared and multiplied into the height, gives one foot one inch and six parts for its contents. At thirteen years old, the tree will be nineteen and a half feet high, twenty-six inches in circumference at the ground, and thirteen inches at half the height: one-fourth of thirteen gives three and one-fourth inch for the girt. This, squared and multiplied into the height, gives one foot five inches and one part for the contents. Deduct from this the contents of the tree at twelve years of age, and there remains three inches and seven parts, which is the increase in the thirteenth year. Then reduce the contents of the tree when twelve years old, and the increase in the thirteenth year, each into parts, dividing the former by the latter, and the quotient will be 3·76; by this number divide 100, and the quotient is 26·5, which is the rate per cent. of increase made in the thirteenth year; consequently, whatever the tree might be worth when twelve years old, it will, at the end of the thirteenth year, be improved in value after the rate of L.26, 10s. per cent., or, in other words, that will be the interest it will have paid that year for the money the tree was worth the preceding year.

" At every succeeding period, both in this table and table I., the like process is gone through.

Mr. Waistell's Observations on Tables I. and II.

"The preceding tables furnish us with the following useful information: viz.

"1. That all regular growing trees, measured as above, as often as their age is increased one-fourth, contain very nearly double their quantity of timber.

"2. That when a tree has doubled its age, its contents will be eight-fold.

"3. But when a tree has doubled its age, the annual growth will be increased four-fold.

"4. Consequently, that when a tree has doubled its age, the proportion that its annual increase bears in the contents of the whole tree is then diminished one half. For example, it appears by the last column that in the 13th year, the increase of a tree is 26·5 per cent.—in the 24th year, 13 per cent.—and in the 48th year, 6·38.

In the two preceding tables we find, that the rate of increase per cent. per annum is the same in both at the same ages, although the quantity of timber in the second table is six times as much as in the first table in trees of all ages; therefore, when the age of a tree is known, the rate per cent. per annum of its increase is known on inspecting these tables, whether the tree has grown fast or slow, provided the growth of the tree has been regular, and that it has continued its usual growth.

And having the age, girt, and height of any tree given, we can readily calculate what quantity of timber it will contain at any future period, whilst it contains its usual rate of growth.

The following table shows the number of trees to be cut out in thinning woods, and the number left standing, at every period of 4 years from 20 to 64 years, reckoning that the distance of trees from each other should be one-fifth of their height, and that the trees have increased 12 inches in height and 1 inch in circumference annually, and to have been at first planted 4 feet apart.

TABLE III.

Years old and feet high.	Girt.	Contents.			Distance.	Number of trees on an acre.	Contents of the whole.	Number to be cut out.	Contents.
	inch.	ft.	in.	pts.	feet.		feet.		feet.
20	2½	0	10	5	4	2722	2362	839	727
24	3	1	6	0	4·8	1883	2824	494	741
28	3½	2	4	7	5.6	1389	3308	326	776
32	4	3	6	8	6·4	1063	3779	223	792
36	4½	5	0	9	7·2	840	4252	160	810
40	5	6	11	4	8	680	4722	118	819
44	5½	9	2	11	8·8	562	5194	90	831
48	6	12	0	0	9·6	472	5664	70	840
52	6½	15	3	0	10·4	402	6130	55	838
56	7	19	0	8	11·2	347	6611	45	857
60	7½	23	5	2	12	302	7076	37	866
64	8	28	5	4	12·8	265	7537		

The following table shows the same particulars as the last, in woods where the growth of trees has been fifteen inches in height, and one and a half inch in circumference annually.

TABLE IV.

Age.	Height.	Girt.	Contents.			Distance.	No. of trees on an acre.	Contents of the whole.	Number to be cut out.	Contents.
years.	feet.	inches.	ft.	in.	pts.	feet.		feet.		feet.
16	20	3	1	3	0	4	2722	3402	980	1225
20	25	3¾	2	5	3	5	1742	4246	532	1296
24	30	4½	4	2	7	6	1210	5100	322	1357
28	35	5¼	6	8	4	7	888	5944	208	1392
32	40	6	10	0	0	8	680	6800	143	1430
36	45	6¾	14	2	10	9	587	7644	102	1452
40	50	7½	19	6	4	10	435	8494	75	1464
44	55	8¼	25	11	10	11	360	9355	58	1507
48	60	9	33	9	0	12	302	10192	45	1518
52	65	9¾	42	10	10	13	257	11026	35	1501
56	70	10½	53	7	0	14	222	11895	29	1558
60	75	11¼	65	10	11	15	193	12720	23	1515
64	80	12	80	0	0	16	170	13600		

" The following table shows the like particulars, where the annual growth of trees has been 18 inches in height, and 2 inches in circumference.

TABLE V.

Age.	Height.	Girt.	Contents.			Distance.	Number of trees on an acre.	Contents of the whole.	Number to be cut out.	Contents.
years.	feet.	inches.	ft.	in.	pts.	feet.		feet.		feet.
12	18	3	1	1	6	4	2722	3062	839	943
16	24	4	2	8	0	4·8	1883	5021	673	1794
20	30	5	5	2	6	6	1210	6302	370	1927
24	36	6	9	0	0	7·2	840	7560	223	2007
28	42	7	14	3	6	8·4	617	8817	145	2072
32	48	8	21	8	0	9·6	472	10069	99	2112
36	54	9	30	4	6	10·8	373	11314	71	2153
40	60	10	41	8	0	12	302	12583	52	2166
44	66	11	55	5	6	13·2	250	13864	40	2218
48	72	12	72	0	0	14·4	210	15120	32	2304
52	78	13	91	6	6	15·6	178	16294	24	2197
56	84	14	114	4	0	16·8	154	17607	20	2286
60	90	15	140	7	6	18	134	18843	16	2250
64	96	16	170	8	0	19·2	118	20138		

The author has known many young plantations much hurt and destroyed by the change of managers or foresters. He has heard managers or foresters newly appointed, say, that unless they did something new, that is to say, something different from their predecessors, they would be little thought of, even though they were doing what they were well aware, was decidedly detrimental to the interests of their employer, and diametrically opposite to their own better knowledge. If one particular rule, therefore, were laid down, it would prevent this ridiculous and injurious procedure, since the new manager would have no excuse for his innovations. It may be proper here to remark, that much of the success of a plantation must depend on the person to whom the management is entrusted. If the proprietor has neither time nor inclination to attend personally to his plantations, he ought to choose an experienced person to perform the duty; and, if possible, a person that is settled near the plantation, and one who, from age, &c. is likely to retain the situation for some time; because, it is very obvious, that he who plants, ought, if possible, to nurse up the plantation, since, if the plantation do not thrive, his own credit is at stake. On the contrary, the proprietor who is frequently changing his planter, forester, or manager of his plantation, must never expect to see his plantation prosper; for the credit of the new manager rises on the miscarriage of his predecessor; nay, he even conceives he has an interest in neglecting what the other has planted, since what he himself plants will be seen to more advantage. And every succeeding manager, being aware that he will not remain sufficiently long in his situation to see his labours succeed, becomes careless and dispirited, since he wants the stimulus necessary to induce him to go on, and feels he has little or no interest in bestowing any pains to put the plantation into a thriving condition. Such occurrences have, oftener than once, come under the observation of the author.

It will perhaps be urged, that during a period of profound peace, there is little inducement for planting or even for taking care of those plantations which are already on the ground, from the great depreciation in the value of timber, arising from the very extensive importation of that article from America; and the supply from that quarter being inexhaustible, the price will continue low, and hold out no inducement to the planter in this country. Oak wood, it will be said, is not now in demand, as ships of war are no longer required. This species of argument is almost too absurd to require to be controverted. We certainly do at present enjoy a state of peace; but who knows what to-morrow may bring forth? We do enjoy peace, but who shall dare to say how long we shall enjoy it? Other countries are by no means in a state of tranquillity; and the repose of our own has been threatened. An American war has been, and may be still anticipated; and a long state of peace is a circumstance to which we have no right to look forward.

In the event of an American war, the supplies from that quarter will be in a great measure cut off; and, as timber does not resemble any other crop, sown in spring, and reaped in full maturity in autumn, a time of peace is fully as proper a season for planting as a time of war; and the present holds out many advantages for planting, for work is scarce, and labour is done at a cheap rate.

It is in the power of the rich to do much good by employing the poor in such a manner as eventually to benefit themselves; and it is the wish of the individual who publishes this work, to point out the manner in which it may be done in one instance with mutual advantage to the employed and the employer.* It is with this view, more particularly, that he calls the attention of the landholders, more especially of Scotland and Ireland, to the further planting and improving of their waste lands, because there are many thousands of acres in this country, that are calculated for rearing and bearing timber, and are of no use for the purposes of agriculture or pasture. The following pages, he trusts, will point out such advantages as will induce most of the landholders, if not all of them, to turn their most particular attention to a subject, which, if pursued, will be productive of the most beneficial results.

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* See the method, with its advantages, fully pointed out in a letter to the Right Honourable Robert Peel, on employing the operatives, and improving the waste lands of Great Britain and Ireland; also in the Preface to my Miscellaneous Reports of Surveys of Woods, &c. published 1827.

Though ship-building on behalf of the government is not now so extensively carried on as formerly, still the building of ships of war is carried to such an extent, even at the present moment, as would, in other countries, be considered enormous. Add to this, that Britain, the first commercial nation in the world, possesses more merchant ships than almost all the other countries of Europe put together; it must follow, that oak, even in times of the most profound peace, a period favourable to commerce, must meet with a ready market. British oak, more especially Scotch oak, must always be in demand, from the well-known fact, that a Scotch oak plank will last three times as long as a plank of American oak.

It has been said by some, that there is no danger of timber becoming scarce in this country. But if we consider the great quantity used in ship-building, we must hesitate to admit this assertion, and contend for the contrary; namely, that there is every reason to suppose it will become scarce, more especially should the supply from America be cut off. This will be the more readily admitted, when we consider the enormous quantity of wood required to build a seventy-four gun ship.

Mr. Marshall, treating of wood lands, &c. says, "A seventy-four gun ship swallows up 3000 loads* of oak timber, which is no less than 150,000 cubic feet." He also adds, "It will, of course, take 2000 large well-grown timber trees, of two tons each." Now, supposing these trees to have stood at the distance of thirty-three feet from each other, the distance they should stand at in a plantation for such trees, each statute acre would contain forty trees, consequently the building of one seventy-four gun ship would clear, of such wood lands, the timber of 50 acres. This quantity is certainly very great; and, of course, an equal proportion will be required, according to their size, from a cutter to a three-decker.

Supposing all the waste lands in Scotland (which, by the Report of a Committee of the Board of Agriculture, amount to no less than 14,218,224 acres) to be covered with full-grown oak timber, it would prove very inadequate to replace the British navy and merchantmen as they stood during the last war with France. It must thus be apparent that it is absurd to say there is no use in planting, and that there never can be a scarcity of timber fit for shipbuilding.

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* A load of round timber is forty feet, and of square timber fifty feet; which forty feet of round or rough timber are reckoned a ton, and fifty of square timber a ton.

We can state from good authority that the annual consumption of timber used for the British navy and merchant ships alone is not less than 9,963,480 cubic feet; and the quantity used for house-building, machinery, and agricultural purposes, will not be less than four times that quantity. Now, any one who considers for a moment, that nearly the whole of that enormous quantity is imported annually from foreign parts into England, Scotland, and Ireland; were these foreign supplies to be cut off, I could aver that, before twelve months, we would, to our sad experience as a nation, see a scarcity of timber. From the returns of the King's forests, it appears that, through mismanagement and inadequate regulations, they do not, on an average, furnish above one-fortieth part of the oak timber required annually for the navy and commercial purposes of Great Britain.*

An argument that weighs heavily against planting, particularly with proprietors who are considerably advanced in life, is, that they will not live to see them become ornamental to their estates, far less to reap any profit from them. This is all very true; but does the present generation owe posterity nothing? Is the present proprietor justified in scourging the estate, by cutting and not planting, in the same manner as a tenant would do who is left to the freedom of his own will, and who, towards the end of his lease, scourges and scourges the ground, till he leaves his whole farm not worth one shilling per acre? We certainly owe our posterity much as well as our country; and the proprietor who plants the waste lands on his estate, serves his posterity more, besides beautifying the country, than the proprietor who adds as many acres of land to his estate by purchase,—as has been already shown.

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* See Abstract on Woods and Plantations, by the Rev. Mr. Hamilton, minister of Ashkirk.

But the most difficult of all objections to planting in some, and, indeed, in too many cases, is still to be overcome; that is, on entailed estates. Have we not often seen trees, that have been the work of ages in rearing, cut down without the least regret, and the estate at once disfigured and disgraced? As to the merits or demerits of entails I have nothing to do: but would it not be advisable for the present proprietor of an entailed estate, to consult with the apparent heir of entail, and let him pay at a fair valuation for whatever is planted for the improvement of the estate, as also for some of the old timber to remain on the estate, rather than allow it to be cut down; and thus keep up the respectable look of the place. There is, I believe, a society now formed for taking into consideration entails and entailed estates, which is to give relief in certain cases, of the nature of which I am not sufficiently informed. I hope, however, that the planting and preservation of trees will be attended to. I am also of opinion that government would do much good to all concerned, were they to interfere in cases of this kind. To give a stubborn fact as a striking example, I was called on to make a survey and report, on an estate in Sept. last 1827, in which there are numbers of the finest banks, ravines and dens, that can be imagined for growing and rearing trees, and are completely protected by nature from cattle, sheep, and every creature, of course, in their present state, not worth nor paying one penny to the proprietor, and still are quite accessible for carrying away timber and bark. I at once suggested the propriety and great advantage to be gained by planting in oak, or trees of various kinds, in all such places, which, in a few years, as I made appear, would be worth more than the rent of the whole farms, as nothing was wanting but the plants to put them in. There could have been planted and reared up at the expense of L.100 sterling of outlay, no less than 100,000 trees, which, from the locality of the place to good roads and sea carriage, would have been worth at least, in from thirty to forty years, L.100,000 sterling, but I was told the property was entailed, and the proprietor was not inclined to be at any expense in improving. Here was a loss of L.100,000 sterling, which would have been gained in a few years, for the penurious saving of L.100, besides, had the whole been planted with oaks for coppice, the present proprietor could have commenced within 15 years, and had an average annual income for ever after, of from L.1000 to L.2000, and always on the increase. I have often been much surprised to find places of this kind on many estates neglected, which, besides profit, ornament, and cover, should have suggested the propriety of planting. But, besides all that we have said, groves, belts, and plantations on an estate, emblazon the very name of the planter; and his name, long after he is no more, is mentioned with heartfelt gratitude and reverence, and that, too, by strangers passing by, who on beholding the sublime grandeur and majestic appearance of the noblest of all nature's productions, striking his eye with magnificent grandeur on the summit of a hill, long before he arrives at its base, and the valleys also covered with the monarchs of the forest, breaks out in ecstacy, and at once pronounces the place a paradise.* But can strangers, as they pass, look into the desks of a proprietor, and admire his sums of gold and silver, bills and mortgages, &c.? No, they cannot; besides, these may only last his successor a few years after he is gone; whereas his plantations

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* The ancients describe heaven, or a state of future happiness, as being a place abounding with groves of beautiful trees,

&c. And it is surely well worthy of notice, that the oak, one of the most ornamental trees in nature, should, at the same time, be the most useful to mankind. Its leaves are of use; the husbandman is well acquainted with the value of its acorns: every man, as well as the tanner, experiences daily the useful effects of its bark; and the value of its timber is known to the whole world. Was it not the oak, bearing British valour, and navigated by British skill, that raised us, at once, to the summit of national glory? And ought we not to keep it in remembrance, that under God our existence as a nation depends upon the oak? If therefore our forefathers, merely from the magnitude and majesty of its appearance, the veneration due to its age, and gratitude, perhaps, for some few economical uses they might apply it to, paid divine honours to this tree, how much more does it become every landholder, circumstanced as we are, to plant every acre of his waste lands. By this he will beautify his estate, enrich his family, and afford an ample and substantial material to rebuild the wooden walls of Great Britain. Under the shadow of these favourite trees, divine homage hath been often paid to our Creator, and upon its gun-worn boards the knees of British heroes have often bent, and with grateful hearts, offered up thanks for victory to the God of battle and Britain's salvation. Acts like this stamp the oak with that respectability and veneration which is due to it from every British subject.

" This is the place, the centre of the grove:
Here stands the oak, the monarch of the wood.—
If ancestry can be in ought believ'd,
Descending spirits have convers'd with men,
And told the secrets of the world unknown."

will make his name revered for ages; and passers by, enraptured with the delightful scene, will in justice to his memory pronounce the following lines:

"Now, peace to his ashes who planted yon trees,
That welcome my wandering eye:
In lofty luxuriance they wave with the breeze,
And resemble a grove in the sky,
On the brow of the mountain, all barren and bleak,
They flourish in grandeur sublime,
Adorning its bold and majestic peak,
Like the lock on the forehead of time.

Then, peace to his ashes that planted yon trees;
Supreme o'er the landscape they rise;
With simple and lovely magnificence please
All bosoms, and ravish all eyes.
Nor marble, nor brass, could emblazon his fame
Like his own sylvan trophies, that wave
In graceful memorial, and whisper his name
To ages unborn, from his grave."*

I trust that I have sufficiently shown that the planting and rearing of timber is both a great national and individual benefit; and there is no easier way of raising fortunes for younger children. It is so easy, and so certain of success, that it is a crime to neglect it; and the nation, as well as families, suffers by the fault.

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* Referring to the plantations on the high places of the estates of Airthry, Alva, Inverary, and Kinfauns, when seen from the rivers and level surrounding country, their magnificent and sublime grandeur surpasses all description.

How common is it to see the trees about a gentleman's seat, or in a long avenue leading to it, which were planted only to please the eye, of such a value as warms the next heir's heart when he looks at or thinks of them. "Others might as well have been planted," says he, "in waste places as these for ornament;" and he is ready to reflect on his parent for not doing it. But let him take care to do for his son what would have been so acceptable to himself. I have heard a most respectable and extensive landed proprietor in the Highlands of Scotland, yet in life, and who made most expensive and extensive improvements on his estates, often say, that if he had planted wood, particularly oak, when he came to his estates and began his improvements, in place of improving for cropping, grazing, and rearing cattle, he would have had many thousands of pounds in his pocket at that time; although he only experienced the effects of it in one small instance, having, in 1822, sold a lot of wood, for about L.2000 sterling; which, if it had been put together, would not have covered from twelve to fifteen acres of ground; and which was, on an average, under thirty years old, and grew on places that could neither be cropped nor pastured to pay any thing.

Having viewed the planting of trees as a great national and individual benefit, may we not contrive a method by which it may also become of the greatest benefit to the tenants of farms? In the sequel it will be clearly shown, that, of all agricultural pursuits, none is more profitable than planting and rearing trees, either for cropping or standing timber; and might not this easily be done by landlords, when they grant leases, by inserting a clause, obliging the tenant to plant a certain number of forest trees yearly during the currency of his lease, in such places as the landlord, or his steward, shall point out; and binding him to protect the same, and replace them when destroyed? As a stimulus, or encouragement, to engage the tenant's attention to the propagation of timber trees, and that he may have a beneficial interest in planting upon the land he occupies, at the expiration of the lease, the trees should be valued by two persons mutually chosen by landlord and tenant, and the landlord to pay his tenant such value as these valuators put upon the trees planted and reared up by the tenant during his lease; and, in case of refusal, the tenant may sell and carry them away.

By this method of securing to the tenant a return of his capital, and the profits of it, many valuable grown clumps, belts, and strips of planting would be produced, which never would have existed otherwise. Besides the advantage of shelter, so essential to the grazing farmer in rearing cattle, every inch of his farm that he could not otherwise turn into any kind of crop, would be occupied with what would bring him money at the end of his lease; and the proprietor would have the advantage of obtaining a stock of timber at a fair value, which he could not have procured but by means of such a reasonable provision on behalf of his tenants, besides having on every one of his farms an abundant supply of timber for all kinds of husbandry purposes. As a proof of the great benefits resulting to the tenants from such leases, take the following example.

'The farm of Crosscaple, parish of Dunblane, and barony of Kinbuck, Perthshire, was taken by Mr. J. Dawson for a two nineteen years lease, and entered to in 1777, or 1778, at the annual rent of L.26 sterling. There was a clause in the lease, that Mr. Dawson, the tenant, should, if he had a mind, plant all the wet ground that he did not think proper to plough, with trees of any kind; and the tenant should be at liberty to use what of that wood he required, during the currency of his lease, for all the husbandry purposes on the said farm, as well as for all the houses he required, or saw meet to erect on said farm. At the end, or expiration of said lease, all the standing timber was to be valued by two persons, mutually chosen by landlord and tenant. And it was expressly stipulated, that if the two valuators chosen did not agree, they were to choose a third person, and his opinion betwixt the arbiters was to be binding on both parties: And to their valuation the landlord was to pay the tenant in ready money. In February, 1817, the year after the lease expired, Mr. M'Arthur, forester in Drummond Castle, was chosen by and on the part of James Dawson, then the tenant, (and now living in Dunblane,) as his valuator; and I was appointed by the trustees for behoof of the heir of Kippenross estate, then a minor. We met on the ground, and each for himself valued the wood. After comparing our valuations, there was a difference of about L.25 sterling. We then named Mr. William Stirling, architect, Dunblane, who divided the difference; and all parties having agreed, fixed the value of the wood on said farm at L.1029 sterling; which sum was promptly paid by the trustees of the estate to the tenants. The whole rent of the farm, paid annually for thirty-eight years, amounted to L.988 sterling. The value paid by the proprietor for the wood was L.1029, being L.41 more than all the rents of the farm during the whole lease; besides, after the first ten years, the tenant had a sufficiency of timber for all house and husbandry purposes during the remainder of his lease. Let it be here observed, that, in valuing the said wood, we proceeded on the data of its being all cut down at the time, and brought to market, which was twenty per cent. lower than the like timber was selling for a few years before that time.

The tenant being left to the freedom of his own will, as to the kind of trees to plant, he very injudiciously planted mostly Scotch firs; whereas, had he planted oak and ash, the soil and situation being well adapted for these kinds, he would have had nearly three times that sum to receive. In all such cases, the trees to be planted and cultivated, the thinning, pruning, and rearing up, should be wholly under the management of the proprietor's forester, which would be of mutual advantage to landlords and tenants, if he was, as he should be, attentive and skilled in his profession. The wood being young, and all very healthy and thriving, it must, of course, (as is allowed on all hands,) advance more in value in one year after that period, than it would do on an average in three years before it; and, viewed and valued as trees thriving, and attached to such land, and affording shelter and ornament thereto, was, at that time, agreed on by all, as worth forty per cent. more to the estate. In this case both the interest of the landlord and the tenant was combined, and both in a very great degree advanced.

If this, or a similar plan, were adopted by both landlord and tenant, and each, in his turn, stimulated to it, would it not be very profitable to the tenant, as well as advantageous to the proprietor, in clothing our naked and barren wastes, even in inland districts, now when roads are brought to such a degree of perfection, and bridges erected throughout almost all the districts of Scotland? By this means, profit, as well as ornament, may be obtained, besides its great advantage in affording shelter to the tenant's sheep and cattle in cold mountainous places; as is shown in the section on planting in this work. But, above all, the great advantages resulting from this mode of procedure, cannot be enumerated where the farm is in the vicinity of sea carriage. Were I the tenant of a farm, I would not leave one inch of it fit for labour unoccupied. What would not bear one kind of tree would bear another, and what was too wet for trees would carry hoop willows; which are equally profitable, and can be reaped every three years. And were I the owner of 2000 acres of land, I would plant (if I wished to make money) 1500 acres of them.

I have no doubt, from what has been said, and from positive proof, which will be seen in the sequel of this volume, that the unprejudiced reader will at once be convinced, that, by judiciously planting, and rearing trees, the exhausted funds of the government may be made up, the nation always kept independent, the exhausted landholder enriched, the country beautified, and the distressed agriculturist relieved. Some will be ready to say, that, if my plan be adopted, there will soon be an over-supply of timber—let it be understood, that, what is meant is only the waste lands, such as can neither be cropped nor pastured to any advantage, and yet would carry timber. The number of acres fit for this purpose in Scotland has already been noticed. It will be a long time before the mountains of Scotland are covered as they were in old times. Through the whole of the extent, for upwards of nineteen miles, from beyond Tyndrum to Tyanne, on the King's House, through the upper or eastern portion of the Glenorchy division, decayed roots of trees, many of them of large size, appear on each side of the road, in the lower parts of the mountain sides, and in the intervening curries and narrow dells, and on the banks of the rivers and lakes; also, patches of natural fir, and other trees, may be seen, affording the strongest indications that the tract was formerly covered with a forest of wood. Indications of similar forests can hardly be questioned, as spreading over all the valleys, hills, moors, and mosses, of Scotland; although, in many places, these marks are not so distinctly visible as in this quarter; where the decay of a considerable part of the forest has been but recent, and where some of it still exists.

Much of these extensive forests was cut down from various views, chiefly to prevent their affording shelter and rallying points to those who maintained the independence of the nation during the efforts that, in different ages, were made to subdue the country. A great part also perished by natural decay; while the pasturing of sheep and cattle on the ground where they stood, and want of inclosure, in the highland parts of the country, effectually prevented their re-production. A ship of immense size having been constructed at Syracuse, by the celebrated Archimedes, 200 years before the Christian era, a proper main-mast could nowhere be found for this ship but in the mountains of Britain. The Emperor Severus employed, in the year 207, legions of auxiliary troops and natives in cutting down the forests of Scotland, in which undertaking he is said to have lost 50,000 men, probably from the pestilential effect of the swamps, as well as the opposition of the Scots. At a much later period, 24,000 axes were employed by John Duke of Lancaster, for the same purpose. Besides, large woods in the north were cut down and burned by the Danes; some forests near Inverary were destroyed by King Robert Bruce, in an expedition against Cummin; and the following order by General Monk, to cut down certain woods about Aberfoyle, is yet extant.—" Whereas the woods of Milton and Glenshort, in Aberfoyle parish, are great shalters to the rebells and mossers, and do thereby bring many inconveniences to the country thereabouts—these are to desire you, on sight heirof, to give order for the cutting down of the woods with all possible expedition, that so they may not any longer be a harbour or shelter for loose, idle, and desperate persons; and heirof you are not to fayle. Given under my hand and seale, at Cardrosse, the 17th May, 1654, (signed) George Monk, To the Right Honourable the Earl of Earth," (Airth.)

These circumstances sufficiently account for the bleak and naked appearance of many of the hills and moors of Scotland, which were once clothed with the finest forests; and much has been done, and still continues to be done, to restore this woody covering, although in several places recent plantations have been grubed up, when they were injudiciously formed on ground more valuable for pasture or tillage. Large logs of oak and other trees have been, and still are, discovered in the high land mosses, even on the north of the river Tay, and also on the north, south, and west of the river Forth. Would it not be a very rational conclusion to draw from this, that the large mosses in Scotland arose from, or owe their origin to trees? For my own part, after all the volumes that have been written, and conjectures formed on this subject, and that, too, by men of talent and ingenuity, I am perfectly of this opinion. Every one who has in the least degree studied the subject, knows, that when timber is allowed to rot effectually, exposed to the open air in the fields, during its decaying there is a something that springs annually from it, and, of course, adds to its quantity; when totally rotten or decayed, and when the whole is found entirely corrupted and covered with earth, it forms a kind of moss. There is a large oak tree in a moss on the estate of Brucefield, in Clackmannanshire, which was found on draining the moss, and proved to be of such an enormous size, that it was scarcely possible to move it, so that the men dug under it, and flattened it on the upper side with axes, and it lies to this day, forming a bridge for carts to cross the ditch. When we think of the immense number of trees on the ground in these forests, the prodigious sizes they had arrived to, the number of ages they had stood; raising the surface of the ground by the annual shedding of their foliage; the prodigious thickness of their trunks, the immense number of their enormous branches; add to this the annual productions of nature, since they were cut and began to consume, besides what must have been carried to them by the overflowing of rivers, &c. the thickness of the moss above the soil from which these trees at first sprung, need create no surprise. Besides, it is obvious that a great many of these trees were of the fir tribe, and would consume much faster than the oaks; and their foliage, both annually and ultimately, would add a great deal more to the mossy substance.

By this it is plain, that our plantations, woods, and forests in Scotland, are dreadfully deficient of what they once were. It is, however, very satisfactory to know that they are wonderfully on the increase for the last fifty years, and I hope, for the good of the nation, as well as private individuals, will still continue. The whole may be summed up in a few words from the pen of the most accomplished writer on this subject, (John Evelyn, Esq.) in his discourses on forest trees. "Since it is certain and demonstrable, (says he) that all arts and artizans whatsoever must fail and cease, if there were no timber in a nation; for he that shall take his pen and begin to set down what art, mystery, or trade, belonging any way to human life, would be maintained and exercised without wood, will quickly find that I speak no paradox."

Since the author formed the intention of publishing, he has received the following letter from a gentleman in Edinburgh; and trusts the matter it contains will form a sufficient apology for its insertion:—

Edinburgh, 8*th August*, 1820.

"Sir,—I am informed by a friend of yours, that you are at present about to publish a Forester's Guide, in which I have no doubt that you will say something as to planting, which I am sorry to see so much at a stand in Scotland at present. As it is an improvement that would not only be a great national benefit, but would enhance the value of private property, and benefit individuals, if it were carried forward as it ought to be; I hope you will not neglect to say something of natural oak woods, which is a subject that little or nothing has been said upon; and, to encourage you to it, I send you an account, the veracity of which you may perfectly rely upon, a description of the natural wood of Sonien, near the city of Brussels, in the Netherlands, which yields an annual revenue of more than £6500 Sterling, and has done so, without interruption, for many hundreds of years, and will continue to do so for ever, if managed with proper attention.

"Sonien is in Brabant, about the distance of a cannon-shot from Brussels, and stretches towards the south as far as to Brienne Allend, and Brienne le Chateau, for the space of three leagues. This is a wood really great and magnificent, so that its circumference comprehends more than seven leagues, that is eight thousand bonieres of land; every boniere contains four hundred measures, and every measure twenty Roman feet; and, according to the use and custom of the country, there are an hundred bonieres of this wood cut every year, which brings in a yearly revenue to the king of about fifteen thousand florins, or twenty-five thousand crowns; and thereby, at the end of every eighty years, the wood that was cut grows again, and renewed as at first, with very tall and great trees of all sorts. I have computed the Roman scudi to be worth about 5s. 1d. Sterling, so that the 25,000 scudi will amount to something more than £6350 Sterling The calculation was made about two hundred years ago, before the wealth of the Indies had circulated through Europe, and reduced the value of money, so that this £6350 may be reasonably supposed to have been, at that time, equal to near three times that sum at present. From which computation, instead of having said £6350, I would be much nearer the truth to have called it £18,000 Sterling."

The author is convinced that no one will doubt, in the smallest degree, after reading the sequel, but that he has been able, by demonstration, clearly to show the great profits and advantages that may be derived not only from natural oak woods, even in our own country, but from every species of planting when judiciously managed by a skilful and industrious forester, and into the hands of such a one only should the management of planting and rearing of woods and plantations always be put. On all wooded estates an experienced and attentive forester is of the greatest importance. I shall finish the introduction by an extract from the pen of Sir Walter Scott, Bart. taken from his review of my Forester's Guide.

" Indeed, it has always seemed to us not the least important branch of this great national subject, that the increase and the proper management of our forests cannot but be attended with the most beneficial effect on the population of the country. Where there lies stretched a wide tract of land, affording scanty food for unsheltered flocks, the country will soon, under a judicious system, show the scene most delightful to the eye—an intermixture of pastoral and sylvan scenery, where Ceres, without usurping the land, finds also spots fit for cultivation; for even the plough has its office in this species of improvement. In numerous places we are surprised to see the marks of the furrows upon plains, upon bleak hill sides, and in wild moorland. We are not to suppose that, in the infancy of agriculture, our ancestors were able to raise crops of corn where we see only heath and fern. But, in former times, and while the hills retained their natural clothing of wood, such spots were sheltered by the adjacent trees, and were thus rendered capable of producing crops. There can be no doubt that, the protection being restored, the power of production would again return; and that in the neighbourhood of the little hamlets required for the occupation of the foresters, the means of his simple subsistence would be again produced. The effects of human industry would, as usual, counterbalance every disadvantageous consideration, and man would raise food for himself and his domestic animals in the region where his daily labour gained his daily bread.

" There would thus arise in the wild desert a hardy and moral population, living by the axe and mattock, pursuing their useful occupation in a mode equally favourable to health and to morality; the woods requiring in succession planting, pruning, thinning, felling, and barking, would furnish to such labourers a constant course of employment, they would be naturally attached to the soil on which they dwelt, and the proprietor who afforded them the means of life would be very undeserving if he had not his share of that attachment; in a word, the melancholy maxim of the poet would be confuted, and the race of bold peasantry, whom want and devastation had driven from these vast wilds, would be restored to their native country. This circumstance alone deserves the most profound attention from every class of proprietors, whether the philosophical economist, who looks with anxiety for the mode of occupying and supporting an excess of population, or the juvenile sportsman, who seeks the mode of multiplying his game, and increasing the number of his *gardes de chassè*; the woods which he plants will serve the first purpose, and, kindly treated, his band of foresters will assist in protecting them.

" We may be thought to have laboured too long to prove propositions which no one can reasonably dispute; yet so incalculably important is the object—so comparatively indifferent is the attention of proprietors, that it becomes a duty to the country to omit no opportunity of recurring to the subject.

" The only decent pretext which we hear alleged for resisting a call which is sounded from every quarter, is the selfish excuse that the profits of plantations make a tardy and distant return. To a person who argues in this manner, it is in vain to speak of the future welfare of the country, or of the immediate benefit to the poorer inhabitants, or of the honour justly attached to the memory of an extensive improver, since he must be insensible even to the benefit which his own family must derive from the improvement recommended. We can, notwithstanding, meet him on his own ground, and affirm that the advantage to the proprietor who has planted a hundred acres begins at the very commencement of the undertaking, and may be realised whenever it is the pleasure of the proprietor that such realization shall take place. If, for example, he chooses to sell a plantation at five years old, or at an earlier period, there is little doubt that it will be accounted worth the sum which the plantation cost him in addition to the value of the land, and also the interest upon the expense so laid out. After this period, the value increases in a compound ratio; and at any period, when the planter chooses to sell his property, he must and will derive an advantage from his plantations corresponding to their state of advancement. It is true, that the landed proprietor's own interest will teach him not to be too eager in realizing the profits of his plantations, because every year that he retains them adds rapidly to their value, but still the value exists as much as that of the plate in his strong box, and can be converted as easily into money, should he be disposed to sell the plantations which he has formed.

" All this is demonstrable even to the prejudices of avarice itself, in its blindest mood. But the indifference to this great rural improvement arises, we have reason to believe, not so much out of the actual lucre of gain, as the fatal *vis inertia*, —that indolence which induces the lords of the soil to be satisfied with what they can obtain from it by immediate rent, rather than encounter the expense and trouble of attempting the modes of amelioration which require immediate expense—and what is perhaps more grudged by the first born of Egypt—a little future attention. To such we can only say, that improvement by plantation is at once the easiest, the cheapest, and the least precarious mode of increasing the immediate value, as well as the future income of their estates, and that therefore it is we exhort them to take to heart the exhortation of the dying Scotch laird to his son, 'Be aye sticking in a tree, Jock; it will be growing whilst you are sleeping.'"

Every one who seriously considers the situation of Great Britain and Ireland, will at once admit that Britain had better be without gold than without timber and men. Away, then, with the Emigration act, while there is so much want of timber, and so much waste lands to improve, which (as is shown to a demonstration in the sequel,) can be done with so much advantage to the nation and to individuals. By having always a supply of men and timber within her islands, Britain may laugh at the shaking of the iron rod of all the nations on the face of the earth, and without which she will one day fall by the hands of her enemies.

He trusts that the treatise, explaining the effectual method of preventing dry rot, which he is enabled to lay before the public, will not only be perused with interest, but, being a thing so essentially necessary, and of such vast importance for the preservation of the timbers and planks of ships, that it will be universally adopted by his Britannic Majesty's government, and put into practice in all his Majesty's ship-building yards. The author, upon trial, has most completely checked the progress of rot in timber, when it was most rapidly advancing; and has also brought the most open porous timber of all kinds, that could not, when made into vessels, or casks, be kept without leaking, to such a degree of firmness and so impervious a state, as to resist blowing, and to keep perfectly tight when filled with spirits, or any kind of liquid; and, of course, the timber made durable.

THE
FORESTER'S GUIDE.

SECTION I.

PLANTING.

It will naturally be expected by some, that, on treating of planting, the author should commence with the Nursery; but he intends this work solely as a guide to the Forester, who, if possible, should be the planter of those plantations he is to have the charge of rearing. A man may be a very good gatherer, preserver, and sower of seeds, rearer of seedlings and plants in the nursery, and yet he may know nothing of the planting and rearing of timber trees. The trade of the nurseryman, and the planter and rearer of out-land plantations, or forests, should be distinct. It has been greatly against the growth and prosperity of plantations in Scotland, England, and Ireland, at least in many counties of them, that the management of plantations has been put into the hands of land stewards, gardeners, hedgers, nay, carpenters and labourers, who only know how to cut down a tree, just because they can work a little with a saw and an axe, and distinguish between one tree and another, and undertake to do a great many different things upon an estate for the same salary. This is one great reason why so many half destroyed, and shamefully neglected plantations appear in our country, and why they never come to be so profitable as they should be to the proprietor. The author has seen far too many cases of this kind, and could give but too many instances of them that have come under his own observation. The management of plantations has not as yet, properly speaking, become a distinct profession; and till men are trained from their youth, and instructed in the practical knowledge of planting and rearing timber, and shall become professed and accomplished foresters. I have reason to fear that many of our plantations will continue in that neglected and unprofitable state in which too many of them now appear. What I mean by an accomplished forester, is, one who understands something of the situation and soil he is going to plant; who can make a proper selection of plants to suit situation and soil, with or without shelter; who can properly prepare the ground, put in the plants, and prune; one who will as carefully watch over, and train them up during their infant state, as he would do over a child he is rearing for some great design, make them grow crooked or straight, to suit every purpose; thin out and rear up to proper maturity; he should know the most profitable purposes each can be applied to, and bring them to the best account when they come to be cut down.

Allow me so far to infringe upon my pledge as to the nursery, as to recommend to every proprietor, who intends to plant to any extent, to set aside a small spot of land for the purpose of rearing seedlings fit for planting out. The spot for this purpose should be well sheltered and dry, and the soil and situation as nearly akin as possible to that in which the trees are to be reared. A selection of seedlings, one, or not exceeding two years old, should be made of the various kinds intended to be afterwards planted, and these being put into the nursery, and allowed to remain two, three, and sometimes four seasons, which may be necessary for some kinds of plants, should then be carefully selected and planted out into the place where the plantation is to be reared, always taking the different sizes and quality to suit situation and soil, as seedlings of all kinds can be got in abundance at all times from the nursery, and that too at very reasonable prices. Nothing can be more advantageous for the proprietor who intends to plant, however small the quantity, than to have a small spot, as a second-hand nursery, so to speak, and to give the plants two or three years in it before planting them out, thus in a great measure naturalizing them both to climate and soil; and the expense of keeping up a nursery of this kind is, in rearing from the seedling to the plant, so very trifling as scarcely to deserve a name. Indeed, when a proprietor has very extensive plantations to rear up, he may have a nursery of his own, and rear his plants from the seeds; but still the expenses of keeping up such a nursery will be found to be much more than buying in seedling plants. When a proprietor's land, intended to be planted, holds a local situation near a nursery, this may not be necessary; or when the soil and climate to be planted is nearly akin to that from which the plants can be got. But I would lay it down as one general rule to be observed, that the plants be reared from the seed or seedling in ground and climate, as nearly akin to that in which they are to be planted as possible; the poorer the ground is, from which the plants are taken, so much the better will they thrive when put into richer ground. How often have we seen plants taken from a rich, good, warm soil, and planted into a poor, cold, exposed soil, not grow one inch in eight years or more, and thousands of them die altogether. And even those that grow, did not make above half the progress they should have done in twenty years. So much for raising the plants; let us now prepare the ground for planting.

The great advantages of planting has already been, I trust, sufficiently proved in the introduction; and as rich good land that may be planted chiefly for ornament, needs no preparation, I shall confine myself solely to land not fit for carrying any other kind of crop, and to plantations intended solely for profit, and having here to contend with soils altogether unimproved, and some of them *(as moss,)* the improvement of which has been but little attended to, I may be allowed to say that the planting of such land is an article of vast consequence to private individuals, and their value to the possessor may be made such as even to recover a half-sunk estate;—taking also into consideration, that the time may not be far distant when, as a nation, we may be shut up within our own bounds for a supply of timber, which would raise the price of it to such a degree as would not only far exceed, but triple the profit mentioned in the introduction;

—so that, upon the whole, it is impossible to name any one thing a landed proprietor can do, that is more for public and private advantage than planting. It is cheap, it is easy, and it is of all methods the best in which a proprietor can make atonement to his successors for his own extravagance; and he who sets about it with spirit, should consider he is working for himself, his heirs, his posterity and his country. The first kind of land we shall treat of improving by planting, shall be moss. Of this soil there are numerous and extensive dry tracts in the hollows and in the declivities of hills, in the interior of the Highlands of Scotland and Ireland. These lands are generally covered with heath, and so little grass, that they are not in their present state worth sixpence an acre. The most simple, easy, cheap, and effectual method of improving these mosses is the following.* In dry moss land, divide it into ridges of seven feet broad; as this plough cuts two furrows at once, run the plough up each of those divisions; if the surface is very full of strong. heath, take a furrow of four inches deep; if the soil inclines very much to moss, and little sward upon it, the furrow may be cut six or seven inches deep: if the ground is very full of strong roots of heath, &c. it may be necessary to take the furrow to the proper depth twice—say four inches the first furrow, and if the ground is a little inclined to wet, and of a very mossy substance, the second furrow may be six or seven inches deep; this can be the more easily done, as the plough is constructed so as to make a very deep furrow even to fifteen or eighteen inches, and the horses always working on the solid surface, or what is commonly called the selion. In general, it may be better to take the furrow at twice, both for ease to the horses, and to have it cut thin for the purpose it is to be afterwards applied to. The ground to be planted is the selion that is betwixt the furrows, and the plants are to be put in at three feet distant from each other, being two plants in the breadth; but these are not to be put straight across, but in an angular form, to stand so much lengthwise in the ridge that each plant will stand eighteen inches from the ridge of the furrow, and three feet betwixt the plants. Thus having divided the ground, and fixed the spot where each plant is to be put in, cut the surface turf that was first turned up by the plough into paces, or lengths of eighteen inches each, and collect these by fours or sixes, to the spot where the plants are to be put in;

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* And here I must introduce a newly invented plough for that purpose, which I may denominate the three-coultered moss surface-raising and draining plough, (for its make and manner of working see explanation of the plate,) as it will answer equally well for both these purposes.

set them up on end, with the upper ends bearing on each other, and spreading them out on the ground, so as to leave a space in the middle, to allow the air to pass through to dry them; and when they are found to be properly dried, they are to be burned. Thus having (as has been already said) two turfs on both sides the whole length, and the plants to stand at three feet between each, there will be four turfs for every plant; but if the soil from which they have been paired off is very poor, and not many roots intermingled, it will not burn, it will be necessary to add a little dry heath, which may be got on the ground, or dry furze under every heap; or if two furrows have been turned up, and the second very poor or nothing but moss, this may be cut into small pieces as peat, and dryed as such; and these added to the heaps, will not only make them burn freely, but also add to the quantity as manure. But if the soil is well clothed with heath or any other stuff, affording a great many roots, the plough being constructed to cut, and throw two furrows each five or six inches in breadth, and going four or five inches deep as occasion may require, this will be found quite sufficient for making a soil to receive the plants in dry moss land.

Supposing the moss to be very wet and level, having little or no declivity for the water to run off, divide such into ridges of forty feet in breadth;

cut a ditch six feet wide at the top, three feet wide at the bottom, and four feet deep, allowing these to stand open; and having, before cutting these drains or open ditches, laid the ground open, as before directed, with the surface-paring or draining plough; take a spade, and give each fur or space opened by the plough a gentle declivity towards each ditch, to carry the water into them, and then burn the turfs, as directed, on every spot where it is intended to put in the plants. It may be here necessary to explain more fully the simplest and best method of burning the turfs, &c. A very easy method of cutting these turfs into lengths is, by making a roller of the trunk of a large tree, placing a cart or box above it, as is often done in the common roller, and fill it with stones, to add sufficiently to its weight to make it cut the turf; and this it can be made to do, by hooping it round at every eighteen inches, and from the middle of each hoop to arm it with a blade all round about, six inches deep, stout at the bottom, to prevent it from bending, and sharp at the edge. The roller thus armed is to be drawn over the whole field crosswise, so that its weight pressing the sharp edges down through the turf turned up, the whole will be easily cut into lengths of eighteen inches, &c.

Having thus given a very convenient and expeditious method of cutting the turf, we are to proceed to the drying, piling, and burning of it, (part of which has been already described ;) but as this is a part of the work in which some expense may be saved, and the principal advantage and end obtained, we must be a little particular ; for, however plain and simple this operation may seem, a great part of the benefit the plants and the planter are to reap from it depends on a very critical attention to every part of the process.

If the soil be light, and the weather warm and dry, the turf will dry with once raising up and turning; but if either its own dampness, or the wetness of the season prevents this, it must be piled together as open as possible in little heaps; where passage being left between the turfs for the wind, they will quickly be dried. Sometimes just setting them on edge against one another will answer the purpose.

When they are dry enough for burning, the turf will, in some places, burn singly and of itself; in others it must be assisted with more inflammable materials. The planter may know whether he must burn it alone, or give it this addition by observing its nature as it is turned up.

When the soil is very poor, the turf thin, and few roots among it, it will not burn alone. On the other hand, where the soil has been better, the turf cut deeper, and there is a great deal of roots in it, and stalks and dry leaves upon it, it will burn alone, and he needs give it no addition.

In the other case, he must strew a little dry heath or dry furze under every heap, and if it be very poor, he must mix some of the dry and inflammable materials among the several turfs of every heap; for it is not only by means of the ashes that barren or moss grounds thus treated are improved, the very heating of them by these several fires tends to divide their particles, and to increase their fertility.

The number of turf sufficient for each heap has been already described, and if they are of the poor kind, a little dry furze should be laid upon the ground under and between them; this is all that is needful. The planter or labourer, then, is to set them up end-ways, and edge-ways, as open as he can: and when all the heaps are thus raised, and have stood a day or two for a farther drying, the furze is to be set on fire; and they will catch from it, and burn away sufficiently for the purpose.

Let us now examine the manner of burning them; for, on doing this properly, as much at least depends as on any part of the work; for, after all the toil and expense, two-thirds of the advantage, from the single circumstance of not regarding, or not knowing the proper degrees of burning, may be lost.

Now, in order to explain this, it is to be observed, that fire carries off all the efficacious parts of most substances; but this it does gradually, and the progress may be seen. The planter wants to reduce this turf to ashes; but as he wants these ashes to enrich his land, he should get them as full of virtue as he can.

If a plant of any kind be put into the fire, it burns away to ashes; but these ashes at different times of the burning differ very much in appearance, and also in their qualities. When the plant first falls into ashes, those ashes are of a blackish grey; and as they continue in the fire they become paler, till they are at length perfectly white. While they are of a dark grey, they have a great deal of taste, but when they are burnt white, they are only a little brackish.

Let the planter mark the course of the operation in the burning of one of these heaps of turf. He will find, provided the fire go on well, that at first all the heap looks blackish and dusky; then the turfs which compose it, after a time, begin to crack and crumble to pieces: a little while after this, he will see them moulder into a heap of reddish or yellowish ashes, with several lumps among them; and a while after this, a great part of the lumps will moulder away, and the ashes, in most parts, become of a pale grey; and in some places whitish

It is easy for him, from the above-mentioned directions, to know in which of all these states the turf is fittest for his purpose. While it is black and holds together, it is burnt but imperfectly; when it begins to crack and crumble to pieces, it comes nearer to a condition for his purpose: but the true state in which it is to be used is, when it is mouldered to pieces, but yet retains a yellowish or reddish colour: the ashes are at this time thoroughly made, and yet they retain their full virtue. After this, every minute that they continue on the fire, they lose some part of their strength.

We are now naturally led to consider the proper degree of heat, for bringing the turf to this state, with least loss of the virtue in burning.

All violence of heat to the turf wastes the virtue which the planter wishes to remain in the ashes: therefore he is to contrive to burn them by a slow and mouldering fire. For this reason, the less additional fuel he uses the better: and that there may be occasion for as little as possible, he will do well to first dry the turf as perfectly as he can. It is for this reason also, principally, that the ashes made from rich turf are found better than those from such as is poorer, for the rich kind consumes by itself, and that slowly.

To preserve the full virtue of the ashes, a slow smothering fire is best; similar to the burning of charcoal. And the planter is also to recollect this, that the inside of his heaps will be always more burnt than the outside, so it is enough, in many cases, if the outside be well cracked, and ready to break to pieces with a small blow. In this, however, no general rule can be given, for the nature of the turf differs so much, that some will hang together till struck, when it is over-burnt, and other kinds will break and fall in before they are half reduced to the proper state. I have taken the only general method; that is, informing him of what is the right state of the burned turf, for giving its full virtue. And his eye must watch this, and take the proper opportunities of continuing or stopping the burning when it is needful.

The planter may guess, by the nature of the turf, what degree of fire it will bear, and what addition of fuel it will want; this he is thoroughly to weigh beforehand, for on this a great deal depends. The practice succeeds best when the heaps burn just as long as they should, and so may be left standing whole upon the ground; and this will depend upon the quantity of fuel, joined to their own particular nature. If too much fuel have been given them, and they from thence continue burning within, after the very outside is done enough, then he is to break and spread them a little, so as to make them go out; but it is much better when they go out of themselves, and remain properly calcined and whole: for when they are thus broke and scattered, if a windy day come, half the ashes will be blown away.

We shall suppose, therefore, according to the direction here laid down, the heaps so well made, and the fuel so justly proportioned to the nature of the turf, that the heaps are all sufficiently burnt and many of them stand entire; or, whether they do stand entire or not, even before they be quite cold, the planter should now set his men to work, and go over every heap; break them down; dig up the solid surface on which they have been burned, at least two feet square round where the plant is to be put into the ground, and not less than a spade-length deep, mixing well the burnt ashes with the soil upon which these were burned. Thus the ashes of the turf will not only fertilize the ground, but this very act of burning, the calcining effect of the fire, does great service to the land, particularly when cold and wet before, so far as it reaches, and renders what was before nothing but a barren waste fit for vegetation.

The best season for undertaking this business is about the middle of May, for at that time the surface of the ground is generally in a good condition for burning. The April rains have made the roots shoot out, and the ensuing warmth has dried it. Beginning at this season also, he will have time for waiting every opportunity, to take advantage of weather, and all accidents, and will have his ground in thorough order for his plants next winter or spring.

Having now prepared the moss ground for receiving the plants, let us attend a little to the kinds to be planted in such soils; and here I would lay it down as an invariable rule, in the soil I have been treating of, as also in all moorish and heathy soils, always to take care to burn the heath and all rubbish of their surface before putting in the plants; and also on all land that requires a soil to be formed, to plant with larch firs, and nothing else, at three feet distant, plant from plant; and let it be here observed, that these plants should not be more than two years transplanted from the seed-bed, and let them be transplanted from the seed into ground and climate as nearly akin to that into which they are to be reared as possible. The ground having been thus previously prepared when the plants are put in, they will be found to grow very rapidly, and will get and keep the ascendency of every other plant as well as all kinds of weeds; and when once above them will kill the strongest whins, broom, heath, &c.; and it is well known, that when there is nothing but larch firs, they even make grass grow upon the barest soils.

It may not be deemed too great a digression from the subject here to mention, what may, I believe, be justly stated as a new discovery to the agriculturist and farmer, that the use of larch fir foliage is an excellent manure for poor land, and when any quantity of it can be obtained it will be found to answer the purpose well, being equal, if not superior, to lime, dung, or any kind of compost whatever. Take the prunings of young larch fir trees when they are from twelve to twenty-four inches long; let them be pruned off the trees before the autumn foliage is fully ripe, so as to fall off; spread them in the furrow, and plough them down, so as to be wholly covered by the next furrow, and should any be turned up by the harrows; let them be carefully covered over. The first year their effects will be but little known or felt; the second year they will produce a crop equal to an ordinary one; during the third year they will produce an extraordinary crop, superior to any, and during even the fourth and fifth years their good effects will be sensibly felt. The twigs must not be sparingly laid on, but as many as the furrows will cover over, as the more laid on, the longer will the ground produce without a repetition.

From one acre of larch firs planted on the above plan, when they come to be thinned out, their prunings will be sufficient for manuring and enriching six acres of poor land for four and five years; and on land where the grub used to make its ravages, it will destroy all such vermin. Again, take the prunings of larch fir trees of every description, old or young, when green or newly cut; spread them close together on the barest pasture grass, and the second season there will be an excellent crop of grass. This has been often manifested; but let experience speak as to the other process. In autumn I spread to the depth of two inches, an onion bed, with larch foliage, and hoed it well in with the soil to a considerable depth below the surface. When I sowed the seeds the ground appeared clean, but before August, although there appeared a good braird of onions they were almost choaked with grass, which it was almost impossible to clear. The second, third, and even fourth year there was an excellent crop without any dunging whatever, and the ground, which was completely overrun with worms, was completely cleared. This plan was tried on a small spot of wheat and barley land, and answered the purpose as described, far beyond expectation or even conception. As larch firs are so easily reared from the seed, it might be proper to rear it for manure alone. I am also confirmed in the opinion, that the small branches of larch fir, or plants of from two to three feet high, but particularly the branches of older trees, if carefully twisted together and properly laid on, would make excellent and durable thatch for houses. Any gentleman having the means in his power, that is, plenty of larch fir and plenty of land, would do well to make a trial of some extent, say on an acre or half an acre; there is nothing to be lost by it, but every thing to be gained, as I am aware it will succeed to his satisfaction; as far as the larch goes he will have a green field in winter and food for cattle when the rest of the fields will be bare. I am not exactly aware if the grass is wholesome for cattle. I should think it is, as cattle eat it freely in a plantation; nor does the larch possess any poisonous matter to my knowledge, and the grass grown by larch has in it a sweetness rather than any other taste, and more so than the common natural grass. But perhaps the best mode of using the larch as a manure would be in a compost, say of moss earth and dung, &c. prepared for one or two years.

If the plantation is intended solely for larch firs, which is very profitable, as will be afterwards shown, they must be thinned out gradually year after year, before they attain a height of more than twenty feet, to stand at equal distances of twenty feet, tree from tree, a distance quite sufficient for rearing the larch fir to full maturity; but this is more fully described in another part of this work. But if the plantation is intended for hard wood, say oak, &c. as there is no kind of soil, however poor, if kept dry, and prepared by larch firs from seven to twelve years, as it may require, but what will carry oaks and other hard wood; and if this is intended, and the larch for the most part being in a thriving condition for the first five or six years, early in spring sixth cut out two larch firs alternately, and put in one oak for every two larch firs so cut out, thus converting the whole into a plantation of oaks at six feet plant from plant. And as these plants of oak thrive and come forward, cut away all the larch firs; the oaks thus managed will be found to make great progress, so much so, that not one plant among a thousand will go back. If any oak plant should die at the top before it loses the growth at the root, be sure to cut it over close with the surface of the ground, slanting it upwards. If this be properly attended to, the plants so cut over will be found to make most rapid progress, and will soon equal, if not go beyond the plants that still continued to grow. Let it be here observed, that oak plants put into situations of this kind, should be very strong, not less than from two to three feet high when put in, and not less than three or four years transplanted from the seed-bed; and care should be taken in putting them and all such plants into the ground, to give them a good large pit, so as to hold a considerable quantity of loose earth well preserved about the root; and when put in, the young fibres of the root should be carefully spread out; and by no means should the fibres be pressed into hard solid earth, so as to twist and break them, which is a great means of retarding the growth of the plant: and, indeed, I have oftentimes found this careless method of planting and putting in the plants, particularly when large, to be the very means of killing them altogether. I would lay it down as an invariable rule, that all plants be thus carefully attended to when put in, as it is a great means of causing them to strike immediately at the roots, and also of furthering their growth and prosperity afterwards. Suppose now, that there is a crop of oaks on the ground at six feet from each other, and suppose the ground to be converted into an oak coppice or natural wood, to be cut every twenty or twenty-four years, which will be found to be the most profitable of all plantations; the whole of the firs should be cut away from them as soon as they are of sufficient strength to be exposed to the weather by themselves, and this may be done when the oaks have arrived at a height of six or seven feet, but no pen can accurately fix the number of years it may require to rear them to that height. I have seen some, when the soil is good, and planted in this way, arrive at the height of six and seven feet from the plant in four years; but when the plants have been cut over, and, originally intended for coppicing, and the shape of the plant not much regarded, I have often seen them grow from six to eight feet in two years. Should any of the plants, or what we may now more properly call trees, go back after the firs have been all cut away from them, or even get stunted in their growth, all such should be immediately cut over close to the ground, as formerly directed, and thus having a healthy root, they will be found to make most rapid progress. Keeping up the number of trees at six feet upon the ground, will be, for the first cutting, a complete crop for a natural oak wood. As soon as they are fifteen years old, the whole should be cut over; and although the bark will not be so very good in point of quality as at twenty or twenty-four years old, as it will be much thinner, still the ground being covered with trees at six feet, and the soil being sufficiently strong to afford the whole good nourishment to that age, the quantity of bark will be such, in ordinary cases, as to produce four tons of bark on each acre, which, valued at L.10 per ton, will be

L.40 per acre for fifteen years growth, which will be found upwards of L.2 per acre annual rent, after deducting interest and expense of planting. But the most powerful and weighty reason for my recommending the cutting of a wood, intended to be reared for a natural or coppice wood, at fifteen years growth, is, that the stools have now attained sufficient size at the root to carry two, three, and four stems for the next cutting, which should be done in twenty years after; and if it is properly attended to, as recommended in the section on Rearing of Coppice, it will pay at least three times more by next cutting. This will be found to be the most profitable of all planting, and the only method by which a proprietor can have a regular annual return. Suppose he has from one hundred to one thousand or upwards of acres turned into this kind of oak woods, and divided into regular *hags* or annual cuttings of twenty or twenty-four years old each, he can have a regular annual income from them of from L.2 to L.6 per acre ever after, (observe this is on poor moss land not worth sixpence an acre formerly,) without the expenses of a single plant; as oak stools, by leading them out at the end of each cutting, so as to occupy new ground, never will run out, and that too from land that was not formerly paying him one sixpence per acre. But, supposing the plantation to be reared up for timber trees to maturity, then it will be most essentially necessary to consider what is the kind of timber that brings the best price in that part of the country where the forest is to be reared; and those trees that will bring the most money, and meet the readiest demand, should, by all means, be planted; but in wet moss-land, those kinds of trees whose roots strike deep will not answer so well as in dry land, although a good deal inclined to moss. When the soil is once properly prepared, almost any kind of tree can be reared to maturity, as may be seen in many parts of Argyleshire, where trees of various kinds are seen, of large dimensions, growing from nothing but moss, excepting what soil their foliage may have made on the surface; and besides, there are many indications of large roots of oak and other trees still remaining, not yet decayed since cut down, in moss-lands in North Knapdale, and along the sides of Lochfine, down towards Tarbert. I would recommend as the most profitable timber trees in almost all parts of the country, the oak, Spanish chesnut, Scotch elm, ash, and plane. As to these trees, see the purposes each is suited to, and used for, with their value, in another part of this work. But supposing the plantation to be turned into a lawn, and to be used as a pasture, to have it interspersed with beautiful trees, to give a variety and grandeur to its aspect, almost all the different kinds should be reared. And here it may be proper to recommend a few of the fir tribe, say the Scotch spruce and silver firs; as these grow to a large size, and live to a good old age; the other kinds should be oak, Spanish chesnut, Scotch and English elms, ash, plane, and beech, and these trees should be put in alternately, one kind after another, at a distance of nine feet, plant from plant, so as they can be thinned out gradually, first to eighteen and then to thirty-six feet distant, tree from tree, at which distance they may stand to maturity in a lawn. In this case three larch firs should be cut out for every plant to be put in; these plants as recommended in the oaks for coppice, should be good large plants when put in, as the larches will afford warmth and shelter to them, so that there is little risk of their going back in growth.

In all places intended to be planted, where the soil is very poor, though not moss, I would recommend to plant larch firs in the way and manner directed, to make and prepare the soil before putting in the trees intended to be reared up; and wherever the ground is covered with heath, whins, broom, or any other kind of stuff, it should all be burned up before putting in plants of any kind, although there may be no necessity for burning part of the surface to enrich the soil; and this will most effectually save the labourer's task, as well as expense, of filling up with new plants yearly; as in this way, and by a careful attention to the pitting and putting in the plant, not one out of one hundred will die; whereas, if allowed to be choked by weeds, &c. fifty out of one hundred may require filling up annually. This I have often seen, and could give many proofs of, as well as the planting of deciduous trees amongst fir, particularly larch, although the plantations should be considerably advanced. If care is taken to thin out the larch so as not to drop upon the plant, I will affirm, that there is not a more speedy and sure method of rearing hard wood plantations than by planting larch firs for a few years before putting in the hard wood plants, especially when there is soil to make. This I have practised, and recommended to all my employers for a number of years past, and have had the satisfaction of seeing the most unexpected and flattering results from it, and could give many instances of their most promising success. One observation founded upon actual experience is undoubtedly worth five hundred plausible theoretical conjectures, and will ever be so estimated by the ingenuous inquirer after truth. Although I have not experienced that of the moss planting in an extensive degree, yet, if it does in a small clump or strip of planting, it will do much better in an extensive forest; and if the few experimental hints I have given shall induce the proprietors of such land to adopt the plan, I am convinced they will, in their happy experience, reap the benefit of it, so that I shall not deem the little pains which I have bestowed upon this subject as thrown away. Attached to no theory, and having no favourite system to support, I invariably follow truth founded on experience, in however plain a dress my want of an appropriate style of language obliges me to state it.

The next kind of uncultivated land or lands, not fit for any kind of culture, which we shall consider, and endeavour to plant, is that of rocky soils, particularly whin rock. Of these there are many thousands of acres through Scotland, that, like the moss, does not bring in one sixpence of annual rent to the proprietors; which could also be planted with wood, and will, in many places, carry fir, oak, and other trees, to maturity; and, in every place, excepting where there is a great proportion of bare rock, coppice oak can be made to grow to be cut every twenty-four years. As a proof of this, I need only call the reader's attention to almost all the Highlands of Scotland. Those who have travelled in almost any part of them must have been struck with agreeable surprise, on beholding oak trees of a very considerable size, and thousands of beautiful natural stools of oak, growing out of the very chinks of the rock, where there is scarcely any soil perceivable. Should this fall into the hands of any reader who may never have been in the Highlands, he may learn the truth of it from those who have travelled; or should it fall into the hands of any who may yet travel, allow me to call their attention to the shores of Lochfine, on many parts close on the side of the public road, from Tarbert up to Inverary; the shores of Lochsween, particularly about Taynish, and the whole of the woodlands in North Knapdale, Loch Haw, and many more places both in Argyle and Perthshire, where proofs of the above can be seen, which will lay a sure foundation for establishing the truth and possibility of the following method of planting all such places; a method which is cheap, simple, easy, and most effectual, although new and opposed by almost the whole of the nurserymen, the reason of whose opposition I am at a loss to discover; for, besides the many undeniable proofs of trials of my own experience within these several years, particularly since I published the first edition, ten thousand proofs stand clear as a sun-beam, in hundreds of places where no human foot ever trod, or voice was ever heard, except the foot of the woodman, and sound of his axe,

The system or method of planting all such land is, *first*, by the acorn or seed of any tree, and, *secondly*, by layering from double shoots of young saplings.

First, By seeds on rocks. In all places of the rock where there is the least chink, though almost close, and only perceivable by the eye for one or two feet in length, if in any degree level, or if not, it may be made so much so, with a stone pick, so as to hold one or two spadefuls of earth; then take the quantity of earth, and put it upon that part or chink of the rock; firm the earth well, and then put in the seed half-way between the chink of the rock and the surface of the earth, and firm it well above the seed. When the rock is of itself level to carry it, put a larger quantity, say not less than three or four spadefuls of earth together, and put in three or four seeds; where this can be done, it will so much the better answer the purpose they are afterwards intended for. Here I would chiefly recommend the acorn, and it alone, when it is solely intended for profit, as a natural coppice wood; but should any place of this kind be required to be planted for cover or ornament, the Spanish chesnut, the elm, the ash, or the plane will do nearly as well, and will give variety to the aspect by mixing them. From the reflection of heat on these rocks, the progress in growth that these seeds will make in one season is truly wonderful. I have often known the acorns grow more than in the best nurseries. Let it be carefully noticed, that, when there is no soil but what is carried to it, whatever progress the seedling has made above ground for the first, second, or third year, every year's growth must be cut over at the end of the season, say in the month of October, cutting it always close by the surface of the earth. By this time the roots will have made considerable progress into the chinks of the rock; nor will any thing be lost by the third year's cutting, as it will make more progress in the fourth year's growth by being cut, than it would have done all the other three, though allowed to grow without being cut, and has no such chance afterwards to fail; or should it, at any future period, have symptoms of decay in the top, let it again be cut over close by the ground. In places where shelter, cover, or ornament is chiefly intended, and where there may be any natural soil, to the deepness of nine or twelve inches, some of the fir tribe do best, as the roots of most of the firs only run upon the surface. But although they may stand for a few years, they either decay, where the soil is very thin, or are apt to be blown down; whereas the roots of the oak trees strike down into the chinks and crevices of the rocks, and find nourishment, and will come to perfect maturity, in such a situation. Wherever there is natural soil at the foot, by the sides, on the top, or in crevices of bare rocks, if the soil is even to the depth of six or eight inches, although the rocks be perfectly bare to the distance of twenty or forty feet from all such places, there is no occasion to carry soil to plant the bare face of the rock in such cases, where there is soil within thirty or forty feet of height or breadth, for it can be carried over this by layering from the plants, as afterwards explained; but put in large strong plants of the kinds of hard wood we have already mentioned: let none of the plants when put in be less than two years seedlings, and three years transplanted: plant these properly by pitting, as before advised; and as soon as they are properly put in, cut the plant over close by the ground. This relieves the plant at once of every incumbrance above ground, such as shaking with the wind, &c. and gives it every chance of striking at the roots, without the least risk of going back, and is of the most essential service to it in exposed situations, as will be afterwards shown.

These may be cut over more than once if necessary, but not unless they get sickly at the top. Nothing is lost by cutting even to the third year, or, I should rather say, every thing is gained by cutting.

As the roots receive additional nourishment, not a single fibre loses a moment of vegetative life; and when all these fibres are full of life, they send up in the moment of active vegetation such a degree of nourishment to the young sapling, as to give a shoot often from three to six feet in one season after the second or third year's cutting. To strangers this may appear surprising, and many will be apt to call the truth of it in question, particularly as few have ventured upon the same ground; but let those who doubt try it in a few plants. This is making no great sacrifice; and I can confidently aver, they will soon experience the truth of it. I would have it laid down as an invariable rule, that to cut over the plants for the first two, three, and sometimes four or five years, as may be necessary, is the cheapest, the speediest, and most effectual method of rearing plantations of the oak, the Spanish chesnut, the elm, the ash, the plane, the birch, the alder, the lime, the Huntingdon and common willow; and these are the only profitable forest trees, with the black and every other kind of poplar. But the poplar will grow in moist or wet places equally well without cutting. One argument against cutting is, that a far better-shaped or prettier tree can be reared from the plant than by cutting. I grant that when ornament is chiefly the object in view it may be the case; but I also aver, that if proper care is taken in pruning and training it up till the tree is eight or ten feet high, the one reared from the cutting may be made as ornamental and as beautiful a tree as that from the plant. The manner of pruning them is shown in another section of this work.

Let me here strictly enjoin the planter or forester to examine his plantation annually, and whenever he sees a plant of the kinds mentioned, should any thing like decay in the top be seen, to cut it over close by the ground, whether it be a plantation of trees for ornament or profit, as by so doing you not only save the expense of putting in a new plant, but thus, while there is life in the root, you save one, or perhaps three years growth of the plantation. But, says the nurseryman, although a plant die the first or second year in the top, which many hard wood trees generally do, and indeed sometimes stand still without making almost any perceivable progress, still these plants, while they retain sap in the roots, always send out a shoot, and sometimes two from the eyes nearest the root, and these form the tree. This, I grant, is true in general, although thirty out of the hundred die altogether; but what kind of a tree does it make? After two and sometimes three shoots come away, each contending for the superiority or main leader of the tree, so that you have it always with two, and often three tops all pushing out in a horizontal direction, what poor pitiful trees do all such make? Will this ever make a rapid, growing, healthy, or ornamental tree? No; it never will. As a proof of this melancholy fact, let a proprietor enter his plantations wherever they are, say from three to eight or ten years old, and, if any thing extensive, thousands of proofs of this will strike his eye on every side. But again, if these plants that die in the top are allowed to stand year after year, depending upon their sending out side shoots from the eyes at the roots, which many of them never will do, they at last die or lose the growth at the root, and then the plant with its two or three years growth is lost. But, says the nurseryman, "when the plant dies at the top, and no appearance of its sending out side shoots, only one or two years growth may be lost, which cannot be helped: Put in new plants, beat up, keep it full with fresh plants." This may be all very well for a nurseryman, but not so for a proprietor; but such is the case.

I have known, and could give name to several plantations, where they had been beating up, as it is called, for six, eight, and nine years, and at that age it was not a finished plantation. In one of these plantations referred to.* I caused a number of these plants that were six years old, but so unshapely and unthrifty as never to be proper trees, to be cut over, and in one season most of them made a push of from four to five feet, which was a greater height than they had gained for all the six and nine years before. In January 1823, there was a very heavy fall of snow in many counties of Scotland, such as had not been for near a century before, which did great damage to the young plantations. The snow was blown to a great height, so much so as to overtop the trees in a belt of planting on the estate of Airthry, ten and eleven years old, called Spittle Hill, consisting of oak and firs. The soil being good, many of the oaks had attained a height of from six to ten feet, and from one to two inches in diameter at the root. When the snow subsided, many of the strongest of the oaks were broken, and twisted as it were to pieces, which rendered them perfectly unfit to remain as trees. Sir Robert Abercromby desired me to look at, and say what should be done with them. About the last week of April, or first week of May, I made Sir Robert's forester cut them all close by the ground; all those that were an inch and a half in diameter at the root, I caused to be rounded down close to the earth, in the same way as dressing a stool of oak, at six or eight inches for the growth in a natural wood; and before the first of September many of them sent out two or three strong shoots from three to five feet high, some of them nearly as tall as the plants were, at eleven years old, before they were broken down. The smaller plants were cut in the usual way with a slope, and generally sent out but one shoot.* The nurserymen say, put in new plants; but I say, cut over, to obtain a cheap, sure, and quick plantation. It is evident a great expense will be saved in plants and planting.

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* On the estate of Airthry, nine years old.

Secondly, By layering. This is a system or method of planting in forests entirely new, and I believe, or at least as far as I ever heard, was never so much as tried by any but myself; but this I have practised for these number of years back. I have tried it with the most universal success, and from experience have recommended it to all my employers, many of whom are now reaping the benefit of it. But here I have got the whole body of nurserymen against me; and when a gentleman speaks to them of layering forest trees, for instance, oak, they at once declare it to be nonsense, chimerical, impossible, and a scheme that will never succeed. Nothing will do, say they, but planting: you must plant. But why condemn a man before he is found guilty? I am not to be driven out of the path of duty, to serve the selfish views of any man; besides, I can have no more interest in lessening the expenses of planting to a proprietor than in selling plants for a nurseryman; and I am convinced, that every improvement in planting and rearing of trees, particularly the oak, must be a national as well as an individual benefit; and no improvement of that kind, however trifling, from whatever quarter it may come, should be withheld from public view.

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* Sir Archibald Campbell, Bart. (Lord Succoth,) had a plantation wholly of oaks on his estate of Garscube, which had stood for upwards of fifteen years, and although on good soil, never were so healthy and thriving as was expected. Although every attention was paid to the rearing of them that possibly could be, still they became stunted in the growth. His Lordship ordered, I think, nearly about the one half of the plantation to be cut over close by the ground, taking the worst side of the plantation; and such was the result, that those cut over sent out such vigorous growths, that many of them the first, and all of them the second year, gained the ascendency over the fifteen years old plants, nor did a single one of them fail that had sap in the root.

The method of layering from the sprig of a plant is well known to all nurserymen; but we must carry the matter a little farther when we go to the forest. The method of layering in forests, which is agreed on by all those who have tried it, is of the very first and greatest advantage in filling up blanks in a natural or coppice wood; and with this we may commence. When the young shoots in a natural wood have finished their second year's growth, say in the month of November or December the second year, (and here, by the way, it may be proper to observe, that, when layering is required, the stools of natural wood should not be thinned out the first year, (as is directed in the section on rearing of natural or coppice woods,) every shoot should be allowed to grow till the layering is performed, the second year's growth being finished as aforesaid. If the stools have been healthy, these will have made a push of from six to nine feet high. If there is a blank to fill up on every side of the stool, take four of the best shoots, and layer them down in different directions in the following manner: take the stem or shoot from the stool; give it a slash with a knife in the under side, very near the stool or root, to make it bend; often times the shoot at this age will bend without using the knife; and when it will bend without using the knife, it should always be done, give it also a slash with your knife about one inch above the eye next the top of the shoot. Should there be but one small shoot near the top, and that chance to be next the ground, not to twist the leader or layer, give the shoot a twist round the body of the layer, and bring it upwards. Make a slit in the ground about six inches long, and of sufficient width to receive the body of the layer. Pin the layer firmly down in the slit below the surface of the earth. This may be easily and readily done with a small pin of wood, about six inches long, with a hook upon its upper end, to keep down the body of the layer; which pins can easily be got from the branches of trees in the wood. Having pinned it firmly down below the surface of the ground, cover over the layer with the turf from the slit; or a little fresh earth may be put in, and press it firmly down, holding up the end of the young shoot from the body of the layer, pressing the ground about the root of it the same as putting in a plant by pitting, &c, leaving also the top of the shoot or stem thus layered down out of the ground. Thus the layering is performed, and in one year, if the root or stool from which the layer is taken be healthy, the top shoot, and the shoot to form the tree, say the small shoot or eye from the top, will make a push of at least two, and I have even known them grow four feet in one season. Nor is there the smallest chance of their misgiving. The top shoot having made a push again in two years of very possibly from eight to nine feet, it can be again layered down, and led out other eight or nine feet; thus in four years completely planting up and covering the ground on all sides from sixteen to eighteen feet, (and supposing you have stools or roots on the ground at a distance of from thirty to forty feet,) in five years you can completely plant up the whole ground without the expense of a single plant. Nor is there the least risk of their misgiving in one single case if properly done; and here also you have a plantation of plants, or we may rather now call them trees, of from four to fourteen feet high, which, by putting in plants, you could not have had for twelve years, besides the expense of much filling up. Let it be here observed, that this plan and method of layering will do in the very poorest of soils. When the layer is carried out to the distance required, it may be disengaged from the old stock or stool, as it will have gained at every layer a new root of its own. If only one layer is required, it may be disengaged at the end of two or three years. Observe, this layering may be performed on shoots or stems from ten to sixteen feet high, provided care is taken not to touch or loose the bark on the upper side of the stem, when you bend it from the stool or root, and, at the same time, you can rear a tree from every shoot from the stem to be layered, taking care always to cover it over with earth, and pin down to the ground the eye or fibre to form the root, in the manner already described; and in cases where the layer is strong, and the fibres strong, cut the shoot to form the root within one inch of the body of the layer. Observe also, that if the layer is large, say from eight to sixteen feet high, and the fibres strong, where the roots are to be formed it may require four or six years before it can be disengaged from the old root, as the larger the fibre the longer it is of striking root, but young shoots, of two or three years growth, will strike the first year. This method of layering may also be performed by bending down the branches of trees, as is plain from the following letter, from an ingenious forester, although numberless proofs of the truth of it could be given.

Mr. Monteath,

I am very happy to hear of your plan of layering trees in forests. Many years have I contended that blanks of plantations could be filled up by layering. I recollect when I cut the wood of Birkhill in Clackmannan parish, for the Messrs. J. Macmurrich and Foyer, purchased by them from Lord Dundas of Westcarse, that we were allowed six years to cut it. As one of the yearly hags, on the north side, was very troublesome to get the wood out, I was obliged to form a kind of road to it nearly two hundred yards in extent, on which we threw rubbish and brushwood, some on the young shoots, and some on the stools of trees that were cut that season, and got leave to lie. This was in 1808. In 1813, Mr. Landels, factor on the estate, gave orders to his gardener, James Coban, who acted as forester at the same time, to get men to prune and weed the said wood of Birkhill. James Coban being quite ignorant of the mode of pruning came to me, begging that I would favour him by going to show the way of pruning oak, with which I complied, and went a part of a day through with him; and, in going through, came to the old road on which the brush and rubbish were nearly rotten. But the shoots that were laid over with the weight of rubbish were springing in many directions, and new fibres taking root, some two, and some three feet from the stools. But, as there were some standing upright, I cut those that were layering, as there was no blank near them. But this convinced me of what layering could be brought to; and, indeed, in every plantation that I have pruned, I see nature giving clear proofs of layering; and, indeed, at the very place that I have been pruning just now, there is a plane tree, or what some people call sycamore tree; and that wood, when young, is very frush for binding to answer layering; but nature has caused one of the lower branches to layer out two feet or better, and to take strong root in the ground, stronger than many plants either you or I have seen. I should be very happy, when convenient for you, to have a conversation with you on the layering and pruning. I am, Mr. Monteath, your most obedient and humble servant,

ROBERT M'FARLAN.

It is plain that, by this method of planting, the face of bare rocks and barren places may be covered with trees to a very considerable distance: every species of hard wood or forest trees will layer in the manner described, the beech, hornbeam, and laburnum only excepted. The profits to be gained by this method of filling up blanks in natural woods, or converting them wholly into oak woods, lands covered with birch, alder, and hazle, no pen can properly describe; suffice it to say, it is a method the most effectual, most permanent, and the most lucrative, (as the layer shoots will produce nearly as much bark when the wood comes of age for cutting, as those from the natural stool,) and of all the methods the most cheap and easy, particularly with the oak.

Since the second edition of The Forester's Guide was published, and so late as November 1826, a year of unprecedented drought, I had occasion to be on the estate of Duntroun in Argyleshire, the property of Neill Malcolm, Esq., where his forester, James Gow, guided by the system laid down in the Forester's Guide, had layered down not fewer than

50,000 oak and Spanish chesnut, early in spring, in one plantation, from natural shoots, &c., and not five layers out of the hundred on an average had misgiven; a very great number of them had made fine shoots of from two to three feet, and were extremely healthy and thriving. The Spanish chesnuts were particularly promising, notwithstanding the uncommon dryness of the season. I am informed many of them have made an additional growth of from four and five feet this season, Nov. 1827, and layering out a second time.

But let us try to make a new plantation in this way, and suppose we are to plant from one to a thousand acres: for example, take one acre; suppose we are to plant it with oaks, &c. at forty feet distant, plant from plant; this requires, on a Scotch acre, only thirty-four, and on an English acre, twenty-seven plants; suppose the soil extremely poor, the surface rough, and covered with whins, broom, heath, or what you will; now, it will cost very little expense and workmanship to be particular in preparing the ground, even adding a little manure, or burning, &c. as has been already recommended, and carefully putting in twenty-seven or thirty-four plants in each acre, and cutting them over in the way formerly described, one man will plant two acres, with ease, in one day, nay, he may do four acres in one day. In good soil, the plants are to be put in strong, as formerly mentioned, and every year's growth cut till the fifth year, when each of them will have swollen at the root from one to one and a half inch in diameter, and will, for the most part, by often cutting, have sent out four shoots; these must now grow till the end of the sixth year's growth, when, if care has been taken in cutting, and proper attention paid to them, they will be from six to eight feet high; they are then to be layered out on all sides; by twice layering, in the manner before described, they will, in eight years, fill up the whole ground, except the diagonal corners, with plants at eight feet distant, plant from plant, (the distances required for a natural wood,) and in four years more, say twelve years, the whole ground can be covered with plants, or rather trees, of from four to twelve feet high. Should some of them, which may be the case, only send out two or three shoots—say the collateral shoots from the layer, which is easily understood, and which will answer equally well—in the same way filling up the diagonal corners with the collateral shoots. Thus, it will be allowed, that a plantation can be reared more effectually, and much sooner brought into a plantation of timber trees, by planting only twenty-seven or thirty-four trees on each acre, than by planting the whole. If the land is extremely poor, and requires a new soil totally to be made, plant in larch firs at three feet distant, plant from plant, between the hard wood trees, which are planted at forty feet, and allow the larch firs to grow for eight or ten years, as described in planting moss lands, which will completely make the soil, when the firs may be cut out, the hard wood trees being cut over the year before cutting away the firs, which should be attended to, and the year after layer the young shoots from stools of the hard wood trees. By this age the roots of the hard wood trees will be about two inches in diameter, and there will be little fear of four shoots from each of them, if care is taken to round the roots, when cut properly down to the ground.

I may here also observe, that the growths or shoots from the layers are not nearly so apt to be checked by whins, broom, heath, or any kind of rubbish, nor to be so readily destroyed by deer, hares, rabbits, &c., as the plants are, as their growth is far more rapid and strong; and they will thrive in almost any soil, however poor; with this difference, that if the soil is very poor, the layer must have a year or two's longer supply of nourishment from the old stool or root.

Besides the security and speed with which a plantation can be made and reared by layering, the saving of expense is a very great advantage. Suppose an acre of land to be planted with oaks, at eight feet distance, it will take 855 plants, which, at four shillings per hundred for such strong plants, will cost upwards of L.1, 14s. per acre; whereas, by layering, it only costs one shilling and fourpence: here is a saving of L.1, 12s. 8d. each acre. The labour of planting and layering will be about the same; while, in planting poor soils, fifty acres out of each hundred may require to be planted three times over. My reason for putting in three seeds or acorns on flat pieces of rock, when there is as much natural soil as will hold them, or even when soil can be laid on the crevices or chinks of the rock, will easily appear to the reader to be so that they can be layered out in all directions. When trials of this method of planting are once made by those who have not yet attempted it, the benefits to be derived from it will be seen to be immense. Let it be here observed, that if the plantation is intended for trees to be reared up to maturity as a standing plantation of hard wood, some of the top layers may be used in filling up the diagonal corners, as in this case sixteen feet will do betwixt the trees, and save the thinning; whereas, in a wood for coppices, they require to stand at eight feet. And when the tree root or stool is about six inches in diameter, when cut over, there will be such a profusion of shoots, from whence the layers are to be taken, as that they can be layered out in all directions. As no language can properly describe this method of layering, so as to make it perfectly intelligible to those who may never have seen it practised, I have given a figure in another part of this work, representing the manner of doing it, which is made so perfectly plain, that I have not the least doubt will enable every one to do it with ease and safety.

In March 1822, I received a letter from a landed proprietor in Wales, which proves the fact and utility of layering to a demonstration, and makes many very useful remarks on the growth of different kinds of trees, and the manner of pruning his woods and plantations, consisting of nearly seventeen hundred acres, which letter I would have inserted here at full length, but unfortunately the gentleman wrote it from London without adding his address; and knowing that the Right Honourable Lord Gwyder is a large proprietor in Wales, I sent his Lordship the letter, in order to obtain the gentleman's address, that I might ask his permission to publish it; his Lordship, in the multiplicity of business while in Scotland, had mislaid the letter; should it cast up, however, before the work goes through the press, it will be added. In speaking of layering, he says, "The only effectual, cheap, easy, and profitable method of rearing underwood, as shelter for game, to prevent poaching, is from natural oak stools. I have (says he) often led out the young shoots, by pinning them down to the ground, to the extent of a great many yards, and that in all directions, completely covering the ground; which affords far better shelter than hazel or any other kind of underwood; and, in every fifteen or twenty years, such of the aspiring shoots as have attained more the form of a tree than underwood, I cut over for barking, which brings me in a very fair annual rent for my land; and I have always, besides, a stock of ornamental trees and underwood on the ground."

We may now advance a step farther, and notice shortly the shelter necessary for a plantation; this having been so luminously treated of by many authors, we may be very short upon it; nothing, however, we may observe, is in general so prejudicial to trees as wind, which, by loosening the roots, and bending the tender branches, stunts them in their growth, keeps them always low and stubby, and sometimes even kills them altogether.* For this reason, we always find that no situation is in general so favourable to the growth of trees in this country as the banks of rivers, and hollow dells between mountains, where, by the form of the ground, they are effectually secured from every storm, and sheltered from every tempestuous blast; but, in more exposed situations, we are under the necessity of effecting by art what nature has denied. And if a plantation of firs, or any other trees, intended chiefly for ornament or shelter, be planted on exposed situations, we must, if we would wish them to thrive, fall upon some method of protecting them when young and tender from the fury of tempestuous winds, otherwise they will inevitably languish, if not perish entirely. The best method for effecting this purpose is to make the plantation of considerable extent where the exposure is bleak, and to plant the trees at first extremely close together—say not more than thirty inches, or at most three feet distant, plant from plant, so that they may mutually shelter one another from the violence of the wind; and as the trees advance so as to require a greater space, let the weakest trees be gradually taken away to give room for those which are in a more thriving condition. And here I would advise that the thinning commence when they have attained a height of five feet, and be gradually carried on year after year, till the trees arrive at a height of from ten to twelve feet, when the thinning should be finished, and the trees, particularly if firs, should be left at the distance they are to stand to be reared up. The manner of thinning should be particularly attended to, as the plantation being planted so thick, if allowed to stand long without being thinned, a mortification of the roots not only often but almost always takes place; and the whole plantation not only suffers in health and prosperity, and becomes stunted in growth, but there is no possibility of thinning it afterwards to keep a proper crop of trees upon the ground. In all plantations on exposed situations of this kind, I would recommend them to be margined with a double or triple row of spruce firs, planted in a triangular form, and two of those nearest the outside may be headed down at twelve feet from the ground, which will be found particularly well calculated for skreen or shelter, either for the interior of the plantation, or for the lands on the outside, which, if pasture land, will afford excellent shelter for live stock, whether sheep or cattle, as the firs thus treated throw out lateral branches, which always continue healthy and feather to the ground. Allow me here to observe, that in making a plantation in such situations for ornament, where a variety of hard-wood trees is required, the kinds already referred to will grow, and can be reared by frequent cutting without any shelter whatever. And here I may also take occasion to observe, that in countries where the indefatigable Sir John Sinclair and others have reckoned it impossible to rear woods or plantations, or trees of any kind, I can boldly aver, that in the most exposed situation, even to the east, and north-east winds, by frequent cutting, the oak, Spanish chesnut, the Scotch Elm, Ash, Plane, and Birch, may be reared either for cutting over as coppice, which is the most profitable, or for ornament, by allowing three shoots at least to be reared up from each stool after the stool or root has attained a diameter of from ten to twelve inches by frequent cuttings. Ten thousand proofs of this kind stand on almost all the western coasts of Scotland, particularly in Argyleshire, where, in all the arms of the sea called lochs, the salt water in many places when the tide is in, not only washes the roots of fine healthy thriving natural oak stools, but in gusts of wind, which are frequent, throws the spray among them for acres, yet they are not the least hurt by it. Let it be here carefully noticed, that thousands of the oak stools I here refer to are on the shores of different arms of the sea, exposed to the north and north-east blasts, and to these only, being screened from the south and south-west by the hills above; and these stools, after being cut over for several years, are equally healthy and productive. Let none, therefore, presume to aver, as has been done by many authors, that the sea air is prejudicial to the growth of trees. What says a great author on this subject?—" Every plantation," says he, " on the western coast, will be most prosperous when sheltered from the south-west." But every one who has travelled these coasts, either by sea or land, will say this is false, as these, exposed to the south-west, are for the most part prosperous. I also boldly aver, that if the method I have laid down, and been recommending, were put into practice in a proper manner, there would be no difficulty in rearing oak woods and plantations all along the north coasts. In all Aberdeenshire and east of Fife, for example, there are several natural oak woods, equally good bark as the West Highlands, and equally productive on different estates in Forfarshire, not far from Arbroath, where the east wind beats upon them from the German Ocean. I must here observe, once for all, that there is scarcely any soil, climate, or situation, however exposed to any wind that blows in this country, that the hardy, venerable, and valuable oak will not grow and thrive in, if proper attention is paid to the cutting and dressing of its roots. Another very important and particular advantage to be derived from frequent cutting, particularly the oak, is, that they will grow and thrive in the most exposed situations without any shelter whatever; and this does away entirely with the idea of planting nurses among oaks, when planted for natural or coppice woods, as by cutting they soon gain the ascendency over every plant, so that if intended for an oak wood, the whole ground should be filled up at once with oaks, without nurses, even in the most exposed places. This is plain to a demonstration from many places in Scotland, particularly in Argyleshire, where oaks on the very tops of hills from 500 to 1000 feet above the level of the sea, are equally healthy, produce equally good bark, and are nearly equally productive with those in the vales, although they are exposed to every gale that blows.

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* Observe winds has not the same effect on natural regularly cut coppice woods, they are seldom injured by exposure.

We may next shortly notice the manner in which belts and stripes of planting, chiefly intended for ornament, warmth, and shelter, should be conducted; and here I must severely censure my predecessors for advising and laying off belts and stripes of this kind so narrow. We can scarcely travel a few miles in any part of the country without seeing melancholy proofs of this. On every hand, there is scarcely a belt or stripe of planting we pass, of thirty years old and upwards, but which, upon inspection, will be found to be either in a rapid state of decay, and in many places extirpated, or presenting great blanks and gaps here and there through the whole, and by no means serving the purpose they were intended for. This injudicious method of grouping up plantations of this kind, which will only make a show for a few years at first, but can never be permanent, should for the future be carefully avoided.

It is well known that plantations of this kind afford excellent shelter for live stock, when the fields around them are in pasture, and also for the crops, and when they are judiciously reared, beautify not only an estate, but the whole country. The method I would propose for rearing belts and plantations, intended for permanency, shelter, and ornament, is the following. In the first place, none of these should be less than ninety feet wide, particularly where the country is bare and the ground cold. In other cases seventy-five feet may do. Having laid off the belt to the width intended, plant a triangular row of spruce and silver firs alternately on the outsides, or the whole may be spruce if the soil be found more suitable for them; and if much shelter is wanted, particularly for live stock, these may be headed down, as formerly directed, at twelve or fifteen feet high. When ornament is the chief object, allow them to grow without heading down; but as the silvers will live to the same age with the spruce, and will thrive on almost the same soil, wet only excepted, (on which the spruce will be seen to thrive better than any of the fir tribes,) I would recommend an equal number of silver firs, as these grow to a large size, and are very ornamental trees, and give variety to the skirts of the plantation. In the interior, plant all kinds of hard wood, particularly those best suited to the soil, and if a soil, where every kind will grow, I would recommend the oak, Spanish chesnut, Scotch elm, beech, and plane, as these will grow to a large size, and live to a great age. The manner of planting these trees, in all such belts or stripes, should be in angular lines. (See a figure in another part of this work, showing distinctly the manner of planting and thinning these belts.) But here it may be proper to observe, that the plants should be put in at first at four feet distant, plant from plant, and the outside row four feet from the fence, and thin out for the first time to eight feet, and the second time to sixteen feet; and, at these distances, the triangular rows of firs may stand, having room to spread out on one side, they will come to maturity at this distance, and their horizontal branches will meet without hurting each other; and, as these do not send out any large horizontal branches, like the oak, &c. they will not be injurious to the fields on either side, although, in crop, the hard wood trees in the interior may be thinned out to twenty-four feet; but all this thinning must be performed before the trees exceed fifteen feet high. If underwood is to be propagated, as shelter for game, &c. the hard wood in the interior may be again thinned out to thirty-two feet distance, at which they may stand, since at this distance they will have room to become large ornamental trees. I here beg to observe, that underwood in belts, stripes, and small clumps, or clusters of planting, are of the greatest imaginable utility to the standing trees, as it greatly facilitates their growth, keeps them always fresh and healthy, their roots always moist and warm; and, besides, when a standard tree is destroyed by storm, or from whatever cause, another tree can at once be reared up in its stead from the underwood, thus keeping the plantation always full of good healthy thriving trees, without the expense of re-planting, &c. If shelter for game is required, I would advise this to be done in the manner formerly advised, by laying from the stools of oak and elm, as this will be profitable, by cutting the ascending shoots every twenty years for barking, as well as keeping a good supply of underwood for shelter, &c. If no shelter for game is required, let the whole underwood be oak, and rear it up from the oak stools, to cut every twenty-four years as coppice for the bark; and if the belts are kept fencible, that is, preserved from cattle and sheep, the oak coppice will be found to pay a fair annual rent for the land; for this method of rearing oak underwood is as profitable as coppice for cutting and barking. (See the Section on Coppice Woods in another part of this work.) If neither underwood, as shelter for game, nor cutting for bark, is required, the belts may be laid open to cattle to pasture through them, in five or six years after the trees have got their last thinning. Observe that trees, in belts of this kind, should never be pruned after they are above four feet high. Nothing can be more disgusting to the eye, than to see trees like poles in plantations of this kind. As my chief design in this, as in the first and second edition, is to confine the volume entirely to a guide to the forester, confining myself to things mostly new, and being as concise as possible, I will wave saying any thing on the planting of land fit for carrying any kind of crop, or any thing as to the planting of groups and clumps of ornamental plantations, as these have been luminously treated of by men of talent and ingenuity, who have trod the ground before me, and on which little new could be said. Their placement, situation, and size, depends on their design on the estate, whether for view, ornament, screen, or shelter, and rests totally as a matter of opinion with the proprietor. One thing should never be lost sight of, that is, as all groups of planting of this kind is always intended for permanence on the estate, the greatest care should be taken in well considering the soil and situation, and to make a proper selection of those trees that will suit such a soil, situation, and exposure, grow and thrive best, live to the greatest age, and become the most ornamental trees.

Of Enclosing.

As the enclosing of plantations is of such vast importance to the rearing of young woods and new plantations, we cannot pass it over without paying some attention to the subject. In most parts of the country, we pass but comparatively few fields, and still fewer plantations, without seeing them exposed to the ravages of every animal. A mock ditch, a ragged hedge, or a broken wall, is, in too many instances, the doughty barrier to defend a valuable property from the inroads of cattle and sheep. Although enclosing, in the first instance, may properly be said to regard the proprietor or landlord, and it most generally does so in the first erection, yet, in general, it is an article of great concern to the farmer, as he is generally bound to keep up the fences, and this is no inconsiderable charge. Indeed I have often known the clause as to fences being inserted in the leases of farms, to be a barrier in the way of landlords and tenants coming to an agreement as to their farms, after every thing else was agreed upon. Besides, many broils and law-suits have taken place between landlord and tenant as to their farms, and allowing their cattle to make inroads into plantations, &c. I have also often known the expense of enclosing deter a proprietor altogether from planting. Seeing such is the case, may I not be justified in proposing a method, by which enclosures may be effectually, permanently, and cheaply affected? And hence I must be allowed to introduce my portable wooden paling, (for a complete description of it, see the Figure and Plate representing it in its proper place in this volume,) which, in point of cheapness, durability, ease of erection, facility of repair, and elegance of structure, has not yet, I may safely aver, been surpassed or equalled in point of fencing, either for the interest of the landlord or tenant. But as this can only be effected where there is a profusion of young larch firs or other small trees, I will here subjoin other methods of enclosing. On the subject of fences in many counties of England, the following letter was sent me by an English Gentleman, which will be of considerable utility if adopted in Scotland, when the soil is good.

"SIR,—As you say little of enclosing in your Second edition of The Forester's Guide, which is the most useful book of the kind I ever read, I send you some account of the enclosures here, as I am in a county where I believe they are the best and strongest in England, and made and kept the cheapest, I shall tell you something of them. You know that over most of England, they make great use of the sloe or black thorn, and common brambles. I have long been of opinion that a mixture of them would make the best fences; for clipping the white thorn, as in a garden, is an expense that farmers cannot be at, and without that they will grow thin, so that the sheep may get through, and the greater cattle will follow them. Cut regularly with sheers is both expensive, and their being kept low, doth not warm the ground so well as if high. They have ditches as usual, and plant the hedge with white thorn, mixed with maple, crabs, hazel, elders, oaks, ash, and elm; and the bank on each side they ram full of black thorn brambles and common briar, to keep it close that nothing can pass. I have seen a setting dog run along the whole side of a field and forced at last to get out at a style. It is necessity makes them keep their fences so strong, for they cannot use paling but for a gate, and must not disturb the deer if once they get into an enclosure, but see a herd of them destroy a coppice wood, or a field of ripe corn, before their eyes; the enclosed lands having been stolen from the forest; and if they do not submit, the keepers will bring an action against them which will end in showing a title. I have walked in lanes a mile long, with a hedge on each hand ten feet high, so close with brambles interwoven with crabs, black thorn, maple, &c. that no bird can get through. When they cut them, as they do, though not so often as in the country, when their fences are only against horses and black cattle, they do not plash them, which weakens the root, but cut them a foot and a half above the top of the hedge. What is on the banks they cut close, then they fix on dry thorn bushes, make a top to stand as high or higher than the stumps of the white thorn, crabs, &c. and hang upon the stumps. The bushes cover all the sides of the banks, and the roots of the stumps being strong, they throw out shoots of half a yard long the first year. The stuff upon the banks runs up upon the dry thorns, which have been laid on them as thick as on a seed-bed, and in two years a stag will sooner take a brick wall; and the gate of an enclosure, if it is not stuck full of bushes, is the weakest part of the fence. The black thorn is best for this use, it is thicker and tougher, and lasts longer. A strong hedge, when cut, yields a great deal of money, besides paying the charges. They make long faggots of the black thorn five or six feet long. The large white thorn, maple, crabs, &c. make good faggots, and the smallest of all for brush fire-wood, the common people having no coal in this county but from London. It is hardly to be believed how thick their hedge row trees are, and once planted doth for ever. When they cut their hedges, which they do sometimes both for profit, and to scour the ditches, they prune up all their young trees. The elm, you know, comes from suckers; the oak, ash, &c. from seeds, which drops into, and is so sheltered by the hedge, and gets up through it, so that one may see the finest young trees pruned up a man's height above what is on the dyke. When a hedge has been lately cut, and these trees stand at three or four feet distance all along the dyke, the elms and sometimes the ashes that are well grown trees, but not what is called timber, they generally prune very high, for sake of the burn wood that is got off, and to give air to the rest that are lower of all sizes. They seldom prune up the oaks so high, because their branches pay well in bark, and otherways when large. In short, in the enclosed parts of this country, it is common to have some hundred pounds worth of timber trees upon a hundred pounds estate per annum. They cut all the timber trees round an enclosure at once, or pick them out every year, and the timber yields as much as the land."

My correspondent is wrong as to the oak and ash, as these will also grow from cuttings, as well as the elm. It is well worthy of remark, and of particular notice here, that in the most of all the counties in England, the proprietors make a great deal of money from trees reared up in their hedgerows and fences, (as is plain to a demonstration from the foregoing letter,) a thing not known, or at least not attended to, either in Scotland or Ireland. I was on a survey and valuation on an estate very recently in Dumbartonshire, where there were some old hedges in which were a great number of fine healthy young oak, ash, beech, and plane trees, that had been planted with the hedge, from six to twelve feet high, and the tenant (unknown, however, to the proprietor) had begun to cut the hedge, and was cutting trees and all, within eighteen inches of the ground, which was no doubt an egregious blunder as far as he had gone; a stop was immediately put to it, and the trees left, and now show a beautiful row of fine healthy trees, and will soon be of great value as timber, besides beautifying the farm. Trees are not very favourable to the growth of hedges, yet by keeping them a little to the one side, many valuable trees might be reared, and the hedge still kept a fence, and this without taking one inch of ground off either the proprietor or tenant. These trees also add to the beauty and shelter of a farm.

> "I have," adds my correspondent, "computed upon the hedge round a small field of four or five acres, let for as many pounds, above one hundred pounds worth of timber trees; and a succession of different sizes, that, with care, will yield as much more every thirty years, so that a man really has thirty years purchase for his land from the timber upon it every thirty years, and the yearly rent of his land to the bargain, without any expense but the first planting."

The tract to be occupied by the new plantations being fixed, enclosing is the next indispensable point of preparation. If this is neglected, or not executed in a sufficient manner, the improver may as well renounce his plan; for though we believe, as above stated, that the judicious tenant will approve of and respect the plantations of the landholders, yet we cannot venture to hope that his zeal on their behalf will impel him to take great trouble for their preservation. Even if he were willing to do so, his shepherds cannot be expected to possess such liberal ideas, and will see with great apathy an inroad of the flock where the enclosure presents a practicable breach. In the spring especially, may do more damage to the young woodland in a few hours time than it can recover in several seasons; the plantation therefore, whatever its extent, must be substantially enclosed. For this purpose, quickset hedges are undoubtedly the preferable means; but these cannot be generally resorted to in the execution of extensive plans such as we point at. In wild coarse ground, thorns will not succeed without much care; in soils of a worse class they will not rise at all; and even where the ground is fittest for them, they require more labour and trouble than can be expected in executing a very large plan, unless the funds of the projector be ample in proportion. Hedges of furze and of larch have been recommended, but they are precarious, and will only succeed when much attention is bestowed on them. The most effectual substitute, we regret to say it, is the dry-stone wall. The materials of this species of fence, generally speaking, abound in the neighbourhood of such plantations as we now treat of. The wall has this great advantage, that it may be said to be major, and competent to discharge all its duties even on the day of its birth, and if constructed of flat or square stones of good quality, properly put together, and well erected. will last for many years. It is commonly the readiest and best substitute for a quickset fence;

but it must be owned that it is extremely ugly, and when once it begins to break down, can only be repaired at a considerable expense, which, after a certain time, recurs very frequently, as the best builders of this species of wall cannot so effectually repair the breaches which time makes in it, but that they are always making their appearance again at the same places. The unpleasing aspect of these walls may in some degree be got rid of by keeping them in hollows; this indeed is to be recommended in every case; and upon a large plan, where much ground is at the planter's command, may be very easily managed. Respecting their failure through time, it is to be remembered it will not take place until the period when breaches may be repaired by wattles made from the plantation itself. We have seen a species of earthen fence, used with very considerable success on ground where stones were hard to come at. The earth was dug out of a ditch, which was made to slope outwards, and to present on the side nearest to the plantation a strait cut of about a foot and a half; on the verge of that ditch arose the wall itself, composed of sods built up to the height of three feet and a half, so that the whole height was about four feet, and sufficient to be respected by sheep and cattle, except perhaps during the time of snow, when no defence can be absolutely trusted to. A single bar of paling placed on the top of this species of vallum greatly improves it. It is the cheapest of all fences, as it may be raised at the rate of fifteen pence a rood by contract. Its duration cannot be exactly calculated; but where the sods are of a close and kindly texture, we have known it at least for nine or ten years without symptoms of decay, and after that age the thinnings of the plantation ought to be used to repair the fence, or, if more convenient, sold, and the price applied to that purpose. A hedge may be raised in the inside of such an earth fence, with considerable ease, as the thorns will grow fast among the loose earth, and if this is resorted to, the hedge will be fit to relieve guard when the rampart or earthen walls become ruinous.

Draining.

Draining is also very essential in planting when the lands are wet; and, if these are boggy or fenny lands, deep ditches must be cut to the bottom of the springs, and these must be of sufficient size to lodge the water, the same as recommended in moss lands; but when the ground is of a rocky bottom, say on the sides of hills, &c. surface-draining will be sufficient, which may easily be performed with the plough. In cases where the plough cannot be got to operate, it must be performed with a spade. But the size of these can only be determined by the wetness and deepness of the soil. Still the whole of these drains in plantations may be left open, as open casts can do no harm in a plantation, when neither pasture nor cropping is required, as the plants are always to be put upon the selion; and if by layering, the layers can with ease be carried across the ditches or furrows, which should always be kept open. There are no trees, however, produced of subaqueous soil which will thrive if planted in an undrained bog, yet there is scarcely any ground so swampy and wet that if it has a level for draining may not be made to bear trees, if the kind of trees are rightly chosen. The spruce, silver firs, common, or every kind of willow, and the poplar, all of which I have known to attain great magnitude in a soil so wet that it was thought impossible any tree would grow. All such places should be planted with such trees; their speed in growth, usefulness, and value, and, of course, profit, will be found in its place in this work. The drains should always be kept open, and cleared out from time to time as they fill up with the foliage of the trees. It will be found, as these kinds of trees advance in size, their demand for nourishment will exhaust a great deal of the superfluous moisture. Willows, &c. will grow well beside the water-courses, but not in them. For the rapidity of growth and value of such trees see elsewhere.

SECTION II.

OF THINNING AND PRUNING TREES INTENDED TO BE NURSED UP TO MATURITY.

THINNING and pruning trees is a subject that has been variously treated of by different authors. Some are for thinning and pruning little or none; others are for pruning a great deal and thinning little. It would be of the most essential advantage to plantations in general, if one rule could be laid down and followed up throughout all the stages of plantations, with regard to their management and previous planting; for then it must, of course, follow, that however short-lived one manager of a plantation might be, it behoved his successor to follow up the same plan that he had begun, and so on in succession. It would be well for the proprietor and his forester to consult before beginning to thin any plantation, and to ask themselves deliberately for what future purpose such a plantation is intended on the estate; if it is to be reared up as a perpetual standing ornamental plantation of timber trees, or a plantation solely for profit, or cutting as a coppice, as a very different procedure in every case is necessary according to the desired object, always keeping the ends in view. Whenever the situation for a plantation is fixed on, the future purpose it is to serve on the estate should always be determined on, and a fixed data laid down for its future government, without which the planter or forester is like a pilot on board a ship in the midst of the ocean, without either a compass or helm. The operation of thinning and rearing should be proceeded in without the least stopping. Supposing you have a plantation to begin to look after, that has been planted with all kinds of hard wood and firs promiscuously, and where the plantation is designed chiefly for profit, not for ornament, and the firs having been planned with a view to nurse up as well as to shelter the hard wood, which is of great use, and is absolutely necessary in situations that are much exposed, when the plants, call them now trees, arrive at five or six feet high, for it is difficult to say at what age of the planting this ought to be done, as the growth will depend much upon the situation and soil; but at five or six feet high, go through the plantation, take away every fir tree that is in the smallest degree impeding, or likely to impede, the growth or overtopping, or likely to overtop, any of the hard woods, taking care to leave a sufficiency of firs for shelter, and particularly on the outsides, or in those sides of the plantation most exposed, going through the plantations regularly every year, or every two years thereafter, and taking away gradually, as may be required, every fir tree, till at the time the hard wood trees arrive at the height of from twelve to fifteen feet, and the trees being of this height, thin out all the hard wood trees to a distance of ten feet tree from tree. Having done this part of the work gradually, till the trees are arrived at the height of fifteen feet, there should not be a single fir tree in all the plantation. It will be easily understood, that by the trees to be taken away I mean nursing trees, or trees for training up the others, unless round the outside or places most exposed, where they may be of use to shelter the interior of the plantation. Supposing now, when your trees are at the height of fifteen feet, you have a plantation wholly of hard wood, and that too of of the most valuable kinds, such as oak, ash, elm, beech, Spanish chesnuts, and plane. I mention these kinds, not only as the most valuable, but as they will most generally all grow, thrive, and come to maturity on the same soil, the oak excepted, which will thrive and grow to maturity among whinstone rock, where there is hardly any soil perceptible, which can be easily seen in the neighbourhood of Inverary, Argyleshire, and in many places of the Highlands of Scotland, and also on the face of the Ochil Hills, such as on the estates of Alva and Airthrey, where there can be seen large oaks growing almost out of solid rock. Here it will be necessary to leave the operations of thinning for a little, and say something of pruning, which is a work that ought to be done with great care and attention, as much of the growth, and also the shape, or rather the valuable purposes that a hard wood tree may be made to answer, depends on its being timeously and properly pruned. In this case the infallible proverb will hold good—"train up a youth in the way he should go, and when he is old he will not depart from it." Trees, by proper management, when very young, can be brought to almost any shape.

SECTION III.

ON PRUNING.

THE great beauty and ornament of a tree is its being well clothed with evenly branches. It is wonderful to observe what nature does for trees in this respect if they have equal room to branch out on all sides, the equality of their branches is truly surprising. Pruning is always detrimental to the health and figure of a tree, and the pruning-knife should never be put on a tree after it is six feet high. When it arrives at this height, its every part, both as to trunk and top, should receive all the shaping and pruning that is necessary, or that human art or ingenuity can suggest, to make it a proper tree, whether for ornament or profit, unless in cases of necessity, where a branch is broken off by misfortune or dies, by all means take all such off close by the bole of the tree, both to preserve the health of the tree, also to have sound timber when it comes into the hands of the tradesmen. Supposing you have a plantation such as I have been describing, in the way of thinning, and supposing the plants to have been properly pruned before being put into the ground, which ought to be the case, and is now generally attended to, after the first thinning, which we suppose is done when the trees are from five to six feet high, go over the whole plantation again, and with a knife prune from off the ash, the beech, and the plane, all such stems and shoots as may seem to be entwined with the main stem, making and keeping the main stems as clean as possible, and drawing them up to a very small top, so as not to injure the look of the tree; still, if it is a forest tree, and intended solely for profit, the value must be more regarded and attended to than the look of the tree, although a different mode of proceeding for an ornamental tree is necessary. It is often necessary, for the health of the tree, to have some branches on the main bole. Those to be left for this purpose should be such as will do least injury to the trunk of the tree when it comes to be timber; and here I would recommend to the forester to be particular in his selection of those to be left, and be sure always that those left be branches that come out horizontally from the bole, and lop off those that rise perpendicularly up with the tree, as these have always a much greater swell at the trunk of the tree, and make far more coarse and often blemished timber, than the branch growing in a direct line out of the tree. In order to assist branches useful for the health of the tree, to grow this way, tie a stone or weight to their top, and let it hang downwards, which will keep the root of the branch from growing to any large size with the trunk of the tree, and at the same time will serve the same purpose in pumping up the juices for the tree's nourishment; whereas the branch that grows up gathers what we term a cleft, and lodges wet, &c. betwixt the trunk and the branch, which always rots the bark, &c. and leaves a blemish in the timber when cut up. This is also the reason of what is called the *bark-gaws* in timber. We often see stripes of bark in boards of timber when cut up, which leaves a hole and renders the board useless; and this is the cause from which it proceeds; and at this time, when any of these kinds of trees have two stems, each contending for the superiority, if it can possibly be done without a material injury to the main stem, it ought to be lopped of, and carefully dressed up, as the value of these trees depends entirely on the cleanness, straightness, and tallness of their boles or main trunks; the value of the branches, even though they become measurable, especially of the beech and plane, being in many places of this country next to nothing—this is the time then to begin to train up the ash, the beech, and the plane, to be valuable trees. The value of the oak, the elm, and Spanish chesnut, depends a good deal on there being crooked, as they are all used in shipbuilding; and indeed crooked elm is valuable for fillies or treads for coach and cart wheels, and these trees require a different treatment in the way of pruning. If you have an oak, an elm, or chesnut, that has two stems, as it were, striving for the superiority, lop or prune off the straightest upright growing stem; and if a tree that is not likely to be of such value be standing on that side, to which the stem left seems to incline to a horizontal position, take away the tree, and give it every chance of growing horizontally. At this time it will be necessary to take away a few of the perpendicular shoots off the horizontal branch; and, indeed, if these branches, which is sometimes the case in these trees, seem to contend, take away most of them; but if they do not, it is better at this time not to prune these trees over much, except the crooked shoots on the horizontal branch, till they arrive at the height of fifteen or even twenty feet. By this time it will be easily seen what kind of tree it is likely to form; and, if it inclines to grow crooked, lighten a little the top of the tree, by taking off a few of the crooked branches on the straighter side, allowing all the branches to remain on the side to which the tree inclines to crook, to give it more weight and to draw most of the sap or juice that way, and it will naturally incline more to the crook; at the same time clearing away any other tree on the side, that may be apt with the wind to whip the side of the tree to which it inclines to crook: also taking away every tree of less value as may prevent it from spreading out to the one side more than the other.

If the tree be considerably advanced, say to twenty feet or more, it should be observed that some of the shoots from the main branch of the tree (for such it may now be called) that was and is growing, and maintaining a horizontal position, if these shoots are rising perpendicularly from it, they ought, even at this advanced period, immediately to be taken off, leaving always most of those suckers, or small twigs, on the extremity of the branch, and on that part of it inclining downwards, to prove the means of drawing most of the sap to that part of the tree, and inclining it to grow still more horizontally. By carefully attending to these few hints, in the way of pruning and training up trees for crooks, experience, as it has taught me, will soon show you the benefit to be derived from it. I have myself tried the experiment with several oak trees, at about twelve feet high, that were a little inclined to crook, and that had also a main branch inclined to a horizontal position. In the course of less than twenty years I had the pleasure of seeing some of these very trees grow so very crooked, that the branch would work in with the main stem or body of the tree, to a complete knee, or square, which is the most valuable of all trees. And as ten trees of crooked oak is required for one straight one, it is of the most essential consequence to have crooked oak trees; and, besides, an oak tree properly crooked, that will answer for a large knee—say the main branch to be fit to work in with the body or trunk of the tree without much waste of wood, and at the same time to have a cleanness and evenness of contexture,—such a tree is more than treble in value the same number of straight trees; and, indeed, knees of oak are extremely scarce and difficult to be got. Elm and chesnut are not so much used for knees as for flooring and foot hook timbers of a ship, which are also very valuable. By carefully attending to these hints a great many valuable crooks may be obtained. But the oak is the most valuable, and the forester would do well to attend in particular to make these grow crooked when they are to be reared for shipbuilding, or trees intended solely for profit, as one foot of good crooked or kneed timber is equal in value to three others, although of the same size.

Tulliallan, 12th Feb. 1824.

Sir,—In your first edition of the Forester's Guide, the system you describe for pruning neglected plantations, and the mode of training young trees intended for shipbuilding, are, in my opinion, concisely done. The latter of which I have tried, and as yet have every reason to believe the mode effectual, provided periodical attention is paid to the point of the horizontal leader, cutting off any perpendicular shoots of the same year's growth, as the principal one growing in the horizontal direction. Also until the unnatural shoots, occasioned from the effect of pruning, are extirpated the bole, which process can be accomplished in three or four years subsequent to each operation of pruning; an instance of which I personally performed in summer and year 1821, upon the estate of Meiklour, (the property of the Right Honourable Lady Keith.) I pruned a considerable number of oak trees, which were then twelve years old, among which were a number whose tops were growing in a horizontal direction of different angles and curves, and were pruned according to your system. The same year, in autumn, I scraped off the unnatural shoots upon the bole. About the middle of August 1822, the same process was repeated, which was easily accomplished, as there were not one-third of these shoots which were the preceding year. And towards the latter end of August 1823, scarcely one of these shoots were to be seen upon the trees; any which were, seemed extremely weak, and their points decayed. Also in all kinds of profitable pruning, have found that this system is the only auxiliary yet in practice, to attain tall clean boles, and wholesome timber.

The expense of scraping off these unnatural shoots (so high as is intended to extend the bole next operation) is a mere trifle, as a man can with ease go over several hundreds per day, provided the operation is begun in time, and afterwards regularly attended to, before they are internally united with the present year's growth; and, permit me to say, attention to that one very particular and important object, is the only and effectual alternative to produce sound and unblemished timber, to attain such must be a chief point in forestry; and no doubt the sole design of extensive planting; but until a mode of this kind, or some other homogeneous is properly established, it is my opinion the owners of wood-land cannot enjoy the value of their estates in the superlative degree.

Pruning young trees, which have been regularly trained from infancy, I have not the smallest hesitation to displace the largest exuberant branches, provided an adequate number of smaller branches are left to produce an abundance of leaves sufficient to concoct their juice. However, the exact number of branches to be left, no pen can with propriety determine, nor even a plate truly represent, farther than the position each lateral should be placed upon the bole, when trees are found that will allow the proper system being carried into effect. But as instances of this nature so seldom occur in practice, without trees have been regularly trained from infancy, in that case, I presume, that the only alternative for those who are unacquainted with the proportion of lateral branches requisite for the future health of trees, should strenuously pay attention to the modes adopted by those who are famed in the profession, *but only those* who can by their works produce sound and unblemished timber.

Early pruning is recommended by all recent writers, with a view to get finished, in a certain degree, as soon as possible; the same principle I do concur with, as the amputating of large branches must very much retard the growth as well as injure the future health of young vigorous growing trees, if the wounds are above one inch diameter; and, at all events, pruning should be completely finished (except thinning the tops) before red wood is into the branches, for so soon as it is, the wound does not externally unite with the subsequent growths; it matters not how much or how little red wood is, but, according to its size, the gangrene extends either in small or large wounds, and no aid can prevent its progress from reaching the heart. This may seem strange to some, but, after a moment's reflection, it may be easily accounted for, as the red wood does not externally unite, it must, and does internally decay, for so soon as a branch is cut when red wood is into it, the wonted nourishment does withdraw to give place for corruption. Also all species of trees, deciduous or evergreen, are liable to decay from the effect of injudicious pruning; the oak and elm in particular, when large branches are amputated, after the trees have attained to the size which might be called timber. Neither does the white or sap wood unite after the trees are old, on account of the wound being so long exposed to the inclemency of the weather, and having lost the strong cementing juice of a vigorous sapling.

What I have said regarding the system of training young trees in general, intended for timber, may suffice for the intelligent to make farther improvements, and a track for the yet illiterate to pursue; in the hope of which, permit me an observation or two upon the system of pruning neglected plantations and trees. However, at present, to attempt a full detail upon that part of foresting, would be superfluous, as just reasons could be produced to fill the sheets of a quarto volume, in respect to the defect of timber occasioned by the various injudicious modes of pruning, &c. Therefore, I will solely confine myself at present to one very particular mode of pruning neglected plantations, above twenty years old, or after the trees are so large that the timber is useful. The general system too frequently practised, seems not altogether to effect the design of its origin; and, should I be asked the reason, the reply would be, because it does not produce sound, but blemished timber; the verity of it none can contradict, as witnesses are in every plantation, and upon every tree without exception, where that most horrible practice of amputating large branches was allowed. I grant, that upon young healthy trees, these wounds may cover, (provided a great number are not cut off at once,) and to all external appearance, the timber perfectly sound, but such is not the case, and those who imagine so, are only deceiving themselves; to prove the verity of it, uncover a wound, the dismal catastrophe will appear. Among the many of these illiterate practices, so prevalent, I shall only point out two instances which occurred upon estates adjoining the one formerly mentioned. In the year 1815 a great number of hedge-row trees were pruned, (principally oak, elm, and ash,) for the express purpose of obtaining tall clean boles, the wounds were in size from three to nine inches diameter, and at this time not one of these wounds is healed over; also what is worse, the boles are completely covered over with unnatural wood or shoots, the top of the trees are in a languishing state, being robbed of their due. In the year 1822 a number of them were felled, which I examined, and those which had large wounds scarcely a sound foot was, excepting the lower part of the bole, where no branches were pruned off. Another instance I remember of being done in the year 1819; the trees were of the same kinds, and pruned like long poles, with a mop on their tops, and are, in every respect, fast approaching the state of the former.

Having seen, and by experience felt, the evil resulting from such injudicious management, I have tried a system of pruning which appeareth to be better adapted for reclaiming neglected plantations or trees, than any one system yet put into practice, or ever can, while the system of amputating large branches exists.

1st, Prune out the small exuberant branches at the top of the tree, but so as not to injure its natural figure, if in case it is not top-heavy; but on no pretence cut any branch above one inch diameter, excepting dead ones, which the tree must be completely cleaned of.

2d, After the top is lightened, prune all the remaining branches upon the tree in every respect the same as pruning young trees

of the same size and species; and be particular to prune off all small unnatural twigs, either upon the bole or branches, so far as they are pruned out, or can reach; and, to finish the tree completely, all moss should be scraped off, which can be done for a mere trifle; an active boy can do the operation well, and as fast as one man can prune.

Pruning, according to this method, will not lengthen the bole farther than nature has determined; however, the reclaiming of neglected plantations or trees, according to this method, will always produce sound timber, which sells at all times at full value.

I am,
Sir, &c. &c.

To Mr. R. Monteath,
Wood-Surveyor, Stirling.

The above letter is quite in point as to pruning, which I trust is apology enough for its insertion.

To return to ash, beech, and plane,—the same method as is used in pruning them at five feet high, ought to be pursued, and carried on until the trees shall have arrived at from twenty to thirty feet high; taking care to train them up to grow as clean, straight, tall, and with as few branches in their main trunks as they possibly can be reared with; as their value, either for machinery or husbandry, depends on their being straight and free from knots, and beech in particular for ships' keels and planks; therefore there should be no pruning allowed on trees after they are from fifteen to twenty feet high. Indeed the sooner the operation of pruning is finished the better, because when done (though sometimes necessary) when the trees are arrived at an advanced age, and even done in the best and most careful manner possible, it not only has a tendency to injure the growth of the tree, but it also leaves blemishes in it, which, though apparently healed up, and the tree looks well, and has not the least appearance of any blemish, when cut up by the tradesman after, shows blemishes, altogether unforeseen when the tree was growing; and entirely owing to bad or late pruning, which renders the timber of such a tree almost useless. The pruning should, therefore, be done when the tree is young, and taken close in to the interior of the bark, with a very sharp instrument; and taking particular care not to hurt or injure any of the bark but where the branch is cut off.

If a large branch requires to be taken off any tree, which may be the case if the branch be dead; supposing this, it is better to take off the branch rather than to let it rot off, for then it generally leaves a wound in which the water lodges; and consequently leaves a blemish in the trunk of the tree. In taking it off, saw it about eight or ten inches from the trunk; sawing it first so far through from the under side, and in sawing it from above, the weight of the branch will cause it to give way before it is quite cut through, without any risk of injury to the tree by splitting. On the other hand, if at first cut close to the trunk it would split down, at any rate it would tear the bark from the body of the tree, and of course very much injure it. Besides, if cut close to the tree, at first the weight of the branch, although it was so far cut below to save splitting, would leave small rents, which the heat of the sun would open, so as to receive water, and consequently very materially injure the tree.

In the event of cutting the branch twice, the second cutting of it prevents all risk; and when cut off with the saw, ought to be dressed up with a sharp instrument to prevent water from lodging in it; and a little balsam, such as recommended in the section on the diseases of trees in this work, spread over it, which greatly prevents either the sun or the wet from proving injurious to it.—But, unless in cases of a very particular nature, large branches, as I have said before, should not be cut off.

We shall leave the subject of pruning, and return to thinning, as in page 119. Suppose the plantation is totally of hard woods, of above fifteen feet high, and after the operation of pruning, for at least one year, of such as required pruning, was finished, it will be proper to thin them gradually year after year, and to take away in a regular manner those trees more especially that are not thriving, and are the most unlikely to become valuable; and, at the same time, to endeavour to keep the remaining trees as regular as possible, in order to have a complete crop upon the ground. This mode of thinning, or weeding, must be carefully attended to, so as not to make gaps or blanks in the planting; and particularly at such places of the plantation as are much exposed, keep the trees there always a little closer or thicker on the ground.

The manager or forester need not be told that the thinnings will now be coming to be of some value; and if to be sold in whatever way, they ought always to be cut down either by or under the constant attendance of the person to whom the care of the plantation is entrusted; and he ought to take particular care, that, in cutting the trees to be taken out, he does not allow them even so much as to fall on those intended to stand, because although little or no damage may be done apparently to the standing tree, yet it has a tendency to loose it at the root, and thereby hurt its growth. Thus, by carrying on the operation of thinning in a gradual manner, it will now and then, as the thinnings are becoming more and more valuable, be bringing in a considerable sum to the proprietor; and this operation must be carried on as need requires, till the trees are from thirty to forty years old, and at this time the plantation should be brought to such a state of perfection, that the trees, (if ash, beech, or plaintree,) should be at least from twenty to twenty-five feet from each other. If the plantation is to be converted into a grove of trees for ornament, and to be pastured under and amongst them, they should be thinned out to stand at a distance of twenty-four feet, tree from tree; but if oaks, elm, or chesnuts, being crooked, or large topped trees, from twenty-eight to thirty-four feet, tree from tree, according as the tops of the trees are in extent; so the distances must be regulated by the tops of the trees, in order to keep them from hurting one another, and not at all by the roots, supposing them forest trees to be reared chiefly for value. Having proceeded so far in thinning or weeding the number of trees now remaining on the grounds, they may be allowed to remain till they are 80 or 100 years old, when a little thinning may again be necessary, as it may still be said that there are too many for a crop, that is to say, more than the ground will carry; but it may be observed, that trees are liable to many accidents, both by wind, lightning, &c. &c. so that making this allowance, it will be necessary to keep them a little plentiful, rather than have them too much thinned, and have thereby but a scanty crop. It will be here observed, that I have, all along, been considering a plantation planted chiefly for profit, not for ornament, and the planter, or at least the person who began to train it up, when the trees were five or six feet high, still continued to train up, or at least the same rules are still to be followed up. Allow me to say, that the profits and advantages from a plantation trained up in this way will be immense, as is shown in a following part of this book.

SECTION IV.

OF NEGLECTED PLANTATIONS.

It is now necessary that something should be said of the thinning, pruning, &c. of neglected plantations, of which there are, I am sorry to say, a great many in this country, neglected either from a want of duly considering the profits that may be derived from them, if even yet attended to, or from an opinion that there must be a good deal of money laid out in the first instance, and that the thinnings, even for some years, will not pay the expenses. It is a pity there should be any obstacle in the way, and I hope, through time, they will be removed.

Supposing now, you have a plantation to begin to, that has been planted perhaps twenty or thirty years ago, less or more, and supposing an axe never had been used, or any thing done to it in the way of training up, it matters not what has been the design, whether it was intended to be all hard wood, all firs, or part of all kinds, you must now consider the crop that is on the ground, or what is likely to be a crop, and go over it, and carefully mark out for standing, to the best of your judgment. And here much caution is to be used in marking those trees, whether hard wood or firs, that are most likely to arrive at maturity; and having done so, immediately set about thinning out a very few of the worst of all kinds as they come in the way; at the same time pruning, as you go along, those hard wood trees which you intended to stand.

If the planting is very thick and close, you must not thin it above half what you are convinced it requires at first, because if the air is suddenly allowed too free admission, it will rather injure than benefit the planting, by stunting the trees in their growth, &c.; and more particularly so if the planting be much exposed. I know a plantation on the estate of Dunnipace, in Stirlingshire, that had been over thinned, after it had attained a considerable age. The reader will be pleased to observe, that the plantation referred to was not badly thinned, for want of skill, as the whole was intended to be cut in course, and the worst trees were taken always first away; still it shows the impropriety of injudiciously thinning a neglected fir plantation before it could be planted up again. In the winter of 1814 the wind struck in upon it, and in one night rooted up almost every tree, leaving only about fifty or sixty standing on an extent of nearly five acres of ground. As the trees were from eighteen to thirty feet in height, besides their top, the desolation was tremendous, and even the expense of clearing the ground was very great, in consequence of the large size of the roots turned up with the trees. I could mention many other cases of a similar nature that have come under my own observation.

In a plantation, therefore, of this kind, I would recommend pruning rather than thinning, so that after having given it a very scanty thinning let it be all properly pruned; and in this case great care should be taken not to cut all the branches or shoots from off the trunk or body of the tree too much, but to thin or lighten the tops very considerably, so as they may not be left at all top heavy, which is a great mean of making them not only easily blown down, but also easily shaken with the wind, so that although not blown entirely down, they are apt to lose their growth, if not altogether, for at least several years. In this case it will be seen, that thinning very sparingly at first, and gradually, as the trees begin to take new hold at the root, is necessary. After having pruned* the whole in this way, not to destroy the look of the top of the tree, but as much as possible to lighten it, it should remain in this state for at least two if not three years, when the operation of thinning ought to commence, and be carried on gradually till finished, in the same manner as described in Section II., p. 121, but with more caution, taking care to give those that you intend to train up to maturity always time to fix at the root, so as to resist the effects of high winds, at least in large numbers, for it is almost impossible but some will, in a plantation of this kind, be blown down. Endeavour always to keep the ground as regularly full as possible of the most valuable trees, particularly when you have a choice. At all events, endeavour to train up such trees as you have on the ground, that you think in any degree thriving, and by no means cut out and make great blanks, as some have suggested to be done, and say they replace them with new or young plants. In such a case I would apply the old Scotch proverb—" You will lose bundles gathering straws;" for experience has told me, that for ninety-nine times out of a hundred, you will lose your plants and the expense of planting, &c.

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* The reader will observe, that this is pruning, of necessity, a neglected plantation.

SECTION V.

OF FIR PLANTATIONS.

As to plantations consisting wholly of fir, a considerable difference of opinion has and does exist. Some, and indeed a great many, are not for thinning at all; hence they say firs always thin themselves, because, when too close pressed, those that are most thriving soon overtop those that are not so thriving, and by this means they soon kill them, so that a plantation composed entirely of firs does by degrees thin itself, and should be allowed to do so. Others again say, that fir plantations should be both thinned and pruned in the same manner as other plantations. My own opinion, however, is, that a plantation composed entirely of firs, and planted with a view to and for profit, should be regularly thinned, though not to such a degree as hard wood, because the purpose for which fir is applied, requires the trees to be perfectly straight, and as clean and as free from knots as possible; and as their value chiefly depends on this, it certainly is, and ought to be, the chief object in training them up for that purpose. Therefore, when trees in a fir plantation arrive at the height of five or six feet, they should be regularly thinned out by degrees, year after year, till they arrive at the height of between twenty and thirty feet; and at this time the plantation ought to have been gradually so thinned, that the trees shall not stand nearer than twenty feet from each other, if common Scotch, spruce, or silver, firs; and, having a fir plantation thinned to this distance, when the trees are from twenty to thirty feet high, it should never be touched in the way of thinning afterwards, but left to itself. At this distance, there is plenty of room for them to grow large, straight, and tall, the only properties that can be possessed by a common Scotch, spruce, or silver, fir.

If the plantation consists totally of larch firs, they ought to be kept a little closer, particularly on the outskirts of the plantation, as they require more shelter than the common Scotch firs; or even where there is a mixture, if much thinned, the larch grows very crooked, which renders it of less value, unless when it is to be used in ship-building, which has not yet become general, though it is a kind of wood well suited for that purpose. A plantation wholly of larch firs should not be thinned out to more than fifteen feet, tree from tree, if they are to be reared up to maturity.

Pruning of Fir Trees.

No species of fir tree whatever should be pruned, because in pruning they bleed so much that it very materially injures the growth of the tree, when the branch taken off is in a thriving state. I have often known fir trees, after being pruned, stand still, and not grow one inch for five or six years; so that I consider the pruning of healthy branches of fir trees as injurious to their growth, and in my opinion it should never be done. But when a branch on any kind of tree, but more especially a fir tree, begins to decay or rot, it should immediately be taken off close to the bole of the tree, as formerly advised, because if permitted to rot off, though it be only a small branch of a fir tree, it always leaves a hole in the trunk where it comes off from it. And although this hole soon fills up, and does not in the fir, as it may in a hard wood tree, lodge water, so as to injure the main body of the tree, yet it always leaves a black mark; which, if it ever grows into a knot, will be seen after the tree has been cut down and sawn into boards. And a knot in a fir tree, from a branch that has been allowed to rot off, is always loose when it comes into the hands of the tradesman; in the working, the knot comes out, and leaves a hole in the board, so that it frequently happens, that after having undergone a very considerable degree of workmanship, it is rendered useless; whereas, if the branch is pruned off close to the bole of the tree before it be quite rotten, if it does leave a knot in the tree (but frequently, if the tree stands a considerable time after, it does not,) it will always be a firm knot, and will by no means come out, even though sawn out into boards half an inch in thickness; so that to cut off carefully the dead branches from the fir tree is of very material service to them in point of value; but do not cut off living healthy branches of any kind.*

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* Here I beg leave to mention again the gentleman's letter from Wales; he seems to have given the first edition of the Forester's Guide a review; and when he writes, he says, "Your little manual is just now before me." And the only place he differs from me, so far as I can recollect his own words, is "You are quite wrong as to not pruning of fir trees. I have pruned fir trees of every description in the plantations on my estate; and I find the trees much more healthy, and thrive better, than when left to nature's pruning. The rosin that emits from the wound acts as a salve, and soon heals it up; and I have no doubt but the timber will be found perfectly sound

Neglected Fir Plantations.

If a fir plantation has been neglected till it has arrived at twenty or thirty, or even forty years of age, if the soil be good, and the trees have taken a good hold of the earth, it will be of very great service to give it a little thinning, but to do it in a very sparing manner; but still, it would be beneficial to do it a little, and especially in those places where the plantation is most sheltered. But if the soil be rocky, and the roots running very much on the surface, (which is often the case with the larch fir in particular,) it ought scarcely to be thinned at all; and, in this case, it may be advisable to allow a fir plantation to thin itself, if it cannot be done without the risk of trees not only being blown down, but loosened at the root by the wind, which is almost as injurious to the trees as being completely blown down. But in every case where it can be done with safety, plantations of fir, as well as of hard wood, should be thinned; because, if properly attended to, the trees will make more progress in two years the one way, than in three the other.

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when it comes into the hands of the workman, provided always this is done when the trees are young. I take especial care to see that all my trees are pruned with the hand-knife; and, when out of that reach, I never allow any pruning." See a Letter from an ingenious correspondent in England, on the subject of pruning fir trees, in the Appendix.

The thinnings also will pay much more than the expenses, and ultimately the crop on the ground will be made to thrive much better, and be of more value. I have known fir plantations much benefited, and others much destroyed, by thinning, as the operation should be wholly guided according to the soil and situation of the plantation. In a belt, clump, or any plantation occupying a conspicuous place on an estate, and where the proprietor was most anxious to keep up the trees as ornamental to the place, yet, from the erroneous idea of doing so, allowed them to grow up without any thinning, till, for want of a sufficiency of nourishment in the roots by their advance in size requiring additional supplies, they became stinted and sickly; and from the height the trees had attained, it was impossible to thin any out without bringing down the whole;—in such a desperate case as this, where all hopes of being able to keep any thing like a crop of trees on the ground had been lost, I fell upon a novel scheme. I cut the top of every fourth tree, or so, leaving it to stand, which, by having a number of branches below when cut, afforded shelter to the rest; and I allowed the tree to die gradually in the roots. As the roots of it died, the roots of the standing-growing trees gained new ground, and received an increased supply of sap, so that there was saved and kept up, a belt, clump, or plantation of timber trees, which would have cost the life-time of one, or perhaps two proprietors, to have replanted. This has proved a most advantageous and successful method, but at the sacrifice of a considerable deal of timber; but this was a mere nothing when we take into consideration the having grown-up trees kept healthy and thriving on a conspicuous place of an estate, where their ornament is of ten times more consequence than their intrinsic value as timber. Another novel, and equally successful method, I have tried in thinning neglected plantations of every kind on hilly ground, and where the situation is exceedingly exposed and the soil bare, whether in a plantation for ornament or profit—that is, always to begin the operation of thinning at the top of the hill, and on the most exposed side, and thin downwards a little every year, more or less, of the plantation, according to the exposure. The tops of them, as you descend downwards, reaching up towards the middle, or so, of the trees thinned out, so far protects them that are thinned till they get new and firmer hold of the earth with their roots. It was always, and is still customary, to thin the most sheltered places of a neglected plantation first; but this I have clearly found, by experience, to be a very bad and destructive plan, as it exposes the already too-exposed part of the plantation in a tenfold degree. Always begin to thin at the most exposed part of a plantation first, by which means you protect both the tops and the roots of your trees from starvation all at once by cold.

There is often to be seen, in the pleasure grounds and pasture fields about noblemen and gentlemen's seats, small groups and clusters of trees, the sight of which is at once melancholy and disgusting to a lover of trees, and looks more like a place abandoned than the seat of a proprietor. This may sometimes have been occasioned by being too early laid open to cattle. This may sometimes be the case, but in nine cases out of ten, it is owing to the neglect of early and timeously thinning. Hence, the trees in many of these clumps, have neither good trunks nor tops, and are very often stinted in their growth. Their stintedness in growth may very likely be owing to being too early laid open to cattle or sheep, particularly, as when the climate and soil is dry, these resort to the trees for shelter in sunshine as well as storm, and by so much pattering with their feet amongst the roots, often lay them bare and dry them up, so that, for want of proper nourishment, the trees become languid and die. To this, together with want of attention to the thinning and proper rearing up of the trees when young, is to be ascribed their miserable appearance as trees. The only and effectual method of recovery for all such, is again to inclose the trees for a few years, and plant in amongst their roots larch, Scotch, and spruce firs, at three feet plant from plant, and allow these to stand till the soil be so moistened that the old trees begin to recover and make new growths, and keep in the underwood till the old trees are fully recovered, when it may again be laid open and the underwood taken out. If the soil be very bad, the most of the underwood may be larch firs, to make a soil. Should there be a few old trees wanted to be reared up, these should be put in, and the kinds most congenial to the soil can be fixed on from the old trees already in the ground. See this explained more at large in the section on transplanting old trees.

SECTION VI.

OF NATURAL OAK WOOD.

In the section on valuing natural oak woods, the profits to be derived from them are particularly pointed out. All that is necessary to be said here, in entering upon the subject in that respect, is, that no kind of cropping whatever will pay the proprietor better than a crop of natural oak coppice wood, to cut every twenty or twenty-four years. A crop of wheat is the only thing that is said to pay the agriculturist extravagantly, so to speak, and this is said to be so abundant in some places, when the land is very good and well manured, as to produce sixteen bolls an acre; and this, supposing the average price at two pounds per boll, is no less than thirty-two pounds per acre. But it will be observed, that there is to be deducted from this the expense of seed, labour, and manure, which will cost at least seven pounds per acre; and the ground or field, however good, before it can carry a crop of wheat to this, or nearly to this degree, must be a year at least in fallow, then you have only L.32 for two years crop, which brings it down to L.16 annually; we must deduct the L.7 off the L.32, which brings it down to L.25, being only L.12, 10s., from which we must also deduct the labouring of the fallow, which we may only call 10s. Again, for cutting down the crop, gathering it in, thrashing, and taking to the market, will bring it down to about L.10 per acre for the very best crop that can be produced by the farmer; and even this produce can only be realized once in four or five years, according to the rotation of cropping the same field. Besides, when I speak of sixteen bolls the acre, it will be seen that I am far above the average of wheat crops in general, even on the best of land; besides, these crops are liable to many failures and misgivings, and it may be said that the best of land, one year's crop with another, will not average more than twelve bolls an acre. This, on the same data, will bring the annual rent or produce down to about seven pounds per acre, even laying aside all the risks of misgiven crops. But here I am going out of my road, and entering upon a subject I am not altogether a judge of. To return, land that will by no means carry wheat or any other kind of crop, will carry natural oak wood; and if it be land, however poor the soil, if free of bare rocks and marshes, it will pay, as will be seen in the sequel, at the rate of ten pounds per acre and upwards of annual rent, without any seed, manure, and, I may add, annual labour, except keeping good fences, and once in twenty or twenty-four years a little thinning of the stools the year after being cut. Nothing can be more profitable, and yield a more steady and sure return to a proprietor than oak natural wood, and that annually, when divided into regular yearly cuttings, which all coppice cuttings should be on every estate, and this would yield a regular yearly income to every succeeding proprietor, particularly when the wood is in the vicinity of a bark market or water carriage; and indeed the way and manner that bark is now manufactured, (as is described in another part of this work,) it is easily conveyed, being chopped small in the wood and put into bags; and good roads being now general throughout all the kingdom, a good horse will take fully a ton on a cart, so that the carriage even from an estate thirty or forty miles inland is but trifling, and will not, even at this distance, take above five or six shillings off the rent of an acre, more than those estates holding a local situation to the market. In planting a field for a natural oak wood, whether in filling up the ground by putting in plants, or by layering, they must be reared to fill up the ground exactly at eight feet distant tree from tree, as almost every soil, however bare, will carry natural oak coppice wood to cut every twenty-four years to maturity as to quantity and quality of wood, and bark at eight feet apart. This gives them just room enough to spread out to produce a sufficiency of crop, and that without overburdening the ground. Besides, if there be more room betwixt the trees or stools, when they come to be cut, the young shoots spread out too much in a horizontal position, and the timber of the coppice stools grows so crooked, that at this age it is fit for nothing but fire-wood or charcoal; whereas if the shoots grow straight, (and when confined to eight feet, they are much more readily reared straight than when they have more room,) the timber of the straight shoots is much more valuable for wheel-spokes, and many other purposes, at the age of twenty-four years.

I would here fix the cutting of all natural oak wood at twenty-four years, as the bark may be reckoned at its prime at this age. And I would here recommend it to every proprietor that has even but one hundred acres of natural oak, that he divide it into twenty-four hags, or yearly cuttings, which will be rather more than four acres to each hag, and sell or cut a hag yearly. This will produce an annual income; and in almost all places of the country there are tan works that consume considerable quantities of bark; and in this manner they will not only have a sure and regular yearly income from their woods, but will also afford a regular supply; so that the price will be more steady than by cutting large hags in one season, and as it were glutting the market, so as to produce a fall in the price. Do not understand me as confining the proprietor to 100 acres of coppice wood only. Far be it from me; the more the better for him. What I mean is, that every proprietor that has 100 acres and upwards, should divide these into twenty-four hags or yearly cuttings. Although he should have from 100 to 5000 acres, let them be divided as equally as possible into twenty-four hags, according to their produce, and not exactly according to the number of acres; for if it is rocky land, and where there must be more blank ground in one place than another that cannot be covered with wood, one acre of some of the hags may produce more than three of others, and so on; but always divide them equally according to what they will produce. There are some proprietors in this country, that have from four to seven thousand pounds annually from the produce of their natural oak woods. As has been said before, there is not the least occasion for shelter to a natural oak wood, unless in the entry to a dell, where the wind is accustomed to break in upon it, when blowing from certain quarters, with unaccustomed violence. In this case, it will be proper to have a belt of planting of at least sixty feet wide, altogether of firs, and these always kept very close, to shelter that part of the coppice thus exposed; but after having been once cut, there is no need of shelter in almost any situation however exposed.

If the spot of land intended for a coppice plantation, have some marshy places in it, that will not carry oaks, let them be planted with ash, as ash will thrive in wet situations, where oak will not, and ash will grow naturally, or from the old stock, in a similar manner to oak, and is also very valuable at the same age; but if it be found too wet for ash, let it be planted with birch, as it answers to cut along with the oak, and is of considerable value, as the bark sells at half the price of the oak bark.

None of the oak trees, in a plantation newly formed, and coming forward, intended entirely for a natural oak, or coppice wood, ought to be pruned before the first cutting, as, in proportion to the branches they bear, will the quantity of the bark be increased; so that all should be allowed to grow on them, excepting dead branches, which should always be pruned off, as the very drop from them is injurious to the healthy ones; and if any of the oak plants, or layers, have given way, the ground ought, as soon as it is observed, to be filled up at all ages of the coppice, keeping the ground, as aforesaid, always full; although they should not come forward to be as good trees as the others at the time of cutting, yet their roots will answer the same purpose when it comes to be cut for the new growth.

An oak wood so planted, and intended for a natural oak coppice wood, ought to be cut from the plant, the first cutting at the age of fifteen years, or at the longest not to exceed twenty years, because at this age the roots are of sufficient size to carry four or six shoots, and the natural growth is much more rapid, and at the same time more sure, and less liable to misgive than the plants. There will be, besides, on the ground three or four times the crop, after the first cutting, and there will be from even the second cutting, four times the quantity of bark, and three times the quantity of wood.

Natural oak woods cut the second, third, or any after time, from the natural stock, ought not to be cut sooner than twenty-four years, nor later than thirty, because at this time the bark has arrived at a degree of perfection even more so than when allowed to remain after the age of thirty, for after that age it gathers a quantity of what is called cork; that is to say, the outside, or skin of the bark, becomes rough, and there grows in it a light substance resembling cork, which is not possessed of the principle of tanning.

Oak trees, at the age of twenty-four, or not exceeding thirty years, have as thick a rind or fleshy part of bark as when they arrive at the age of fifty. What may seem strange, but it will be found to be fact, and I make the assertion from personal experience, is, that the bark from a natural stool of oak wood, at the age of twenty-four or thirty years, taking the timber measure, will produce, on weighing, as much as the same measurement of an oak tree at the age of fifty, taking an equal measurement of both trees, foot for foot, and the bark from these at twenty-four is superior in quality, and will bring a higher price.

Thus, after the age of twenty-four, or say thirty years, for the next twenty years the bark gives more to the corky part than to the rind or fleshy part, which is the most valuable. The tanners, or consumers of bark, will give L. 1, 10s. and sometimes L. 2 per ton more for the clean bark at the age of twenty-four, than for the bark which is covered with cork, although much thicker in appearance; in other words, they will give more for the bark of trees, that are only twenty-four, or not exceeding thirty, than for the bark of those that are fifty years old and upwards.

For some years back, it has been customary to cut the natural oak woods at the age of twenty years. But I consider this as rather an early cutting, unless in cases where the woods have not been properly attended to, and where they ought to be cut down in order to improve them. At twenty years old the bark is not nearly so productive, nor is it so good in quality on the branches, as at the age of twenty-four, as in most woods it will be found that the bark swells more both on the main stems and on the branches in one year after twenty, than it did in three years before that age; and, besides, the other four years growth adds in a very great degree to the value of the timber. The rind, as it is called, or inner bark, which is that part of it that is only of use in tanning, will, on an average, generally be found to be no thicker on a tree at sixty years old, four feet above the root, than on the stem of a natural stool of oak at twenty-four years old, although the old tree has a proportion of cork, which only adds to its bulk and weight, without producing any more tanning substance.

SECTION VII.

OF CUTTING COPPICE, OR NATURAL OAK WOODS, FOR THE GROWTH.

The cutting of young natural oak woods, or dressing up the roots or stools, as they are commonly called, for the growth, is that part of a forester's duty, or whoever has the charge of natural woods, that demands the most particular attention; since one stool improperly cut or dressed, spoils the growth not only for the next cutting, but loses the root, and does such injury as it can never afterwards properly recover.

The particular manner in which stools should be cut and dressed up, in order that the new growth may spring up not only for one year, but that they may continue strong and vigorous during the age of the coppice, and to preserve the same stools in health and growth during succeeding cuttings, is a subject that has given rise to a variety of opinions, not only among foresters or managers of natural woods, but also among wood buyers and consumers, who always become the cutters when the woods are sold, which is most commonly done by the proprietors when growing. I have had occasion, for the last twenty-four years, to attend public or private sales of coppice or natural woods, in almost every shire in Scotland; sometimes not fewer than ten or fifteen sales in a season, and on an average not less than seven; and out of these, very few, I had almost said none, of the articles or conditions of sale regarding the cutting and dressing of the stools, &c. when read, gave general satisfaction, even to those who pretended to be judges.

It would prove mere waste of time, and would occupy more room than can be spared in a volume like this, intended for a pocket companion, to state the variety of opinions that have been advanced on this subject. The task would be by no means difficult, but the reader would derive no advantage whatever from it.

I make no pretensions to laying down a perfect rule; I make no claims to perfection, but I hope and trust the rules which I shall lay down will give satisfaction to those who are in any degree competent judges, and such as, when put in practice, will recommend themselves.

Let us commence with a natural oak wood, to be cut for the first time from the plant. If the wood be sold to a merchant, he very naturally tries to make all the wood and bark he possibly can from it, and whenever he begins to cut, (this is quite customary,) he sends a person, generally a woman, before the cutters, to strip off part of the bark from around the root of the tree, from the ground, proceeding upwards for two or three feet. This is commonly termed shaving or hosing the tree. Its design is chiefly to preserve any of the bark from being wasted or lost when the axe is applied. In this operation, however, a very destructive, and not unfrequently a mortal blow is given to the root of the plant; for it often happens that the person has no sooner got in the iron, or instrument intended for raising the bark, and has raised so much of it as to get a hold of it with the hand, than he or she tears it downwards till it runs under the earth, and then it naturally separates the bark from the root of the tree before it breaks, and is the most effectual method that can be adopted for destroying the growth of the stool.

The person upon whom this duty ought to devolve, should be the most careful, as well as the steadiest in the employ, and it would be an additional recommendation if the person should have been accustomed to this operation.

This person ought to be furnished with an instrument with a sharp cutting edge; the hand bill, as it is called, will answer this purpose, and should receive instructions before commencing to strip the bark, to trample down the long grass or foggage all round the root, and then, with the cutting edge of the instrument, to make a circular incision into the bark so deep as to reach the wood, at about an inch above the surface of the earth; thus the bark, when taken off, will injure no part of that which is below the circular incision near the surface of the earth.

The root of the tree being thus prepared, the cutters ought to proceed to their part of the work, not with an axe, however, if the tree should only be but six inches in diameter at the root, as is most generally recommended, but with a saw; because in cutting with the axe, unless the root of the tree be so small in diameter as to be severed by one or two strokes at most, the axe loosens the root to such a degree, that it not only loses the present year's growth, but often fails altogether to grow. Therefore, if the diameter of the root be six inches, or upwards, it should always be cut with a cross-cut saw, entering the saw about half an inch above where the circular incision has been made into the bark, if a small tree; but if the tree be ten or twelve or more inches in diameter, the saw ought to be entered two inches above it.

There are two advantages to be derived from cutting with the saw; it has no tendency to loosen the root of the tree, but also leaves it in such a condition as to be more easily and properly dressed; it also saves a portion of the wood that would otherwise be destroyed by the axe; and this is a great saving to the purchasers themselves, whatever purposes they should apply the wood to afterwards, whether for wheels, spokes, or otherwise. On no pretence, should oaks of the sizes above mentioned be cut with an axe, but always with a saw. Having cut through the tree with a saw, take a sharp adz, and round the edges of the stool, or root, going close down to the surface of the earth, taking with the adz both bark and wood, sloping it up towards the centre of the stool, taking particular care always that the bark and wood both slope alike, as if they formed one solid body, being sure always that the bark be not detached or loosed from the root.

It is of little importance how far up the slice is taken off, or whether the root be rounded close in to the centre, or drawn up to a point, unless it has been cut hollow in the centre with the saw; but, if done in this way, it will be necessary to round as much of the edges as to make it have a declivity from the centre, so as not to lodge water on the top.

If the sawyers would incline the teeth of the saw upwards, it would prevent this occurring, and would render the stool easier dressed. An objection has been made to this mode of cutting with the saw, as taking up too much time; but I have found that two men, with a cross-cut saw, the saw being kept in good order, will cut as much down as two men will with an axe,—and wood will also be saved, and the work done to much better purpose than when cut from the plant with an axe.

I have often found, in cutting trees from the plant, where the root did not exceed ten inches in diameter, that by cutting them with the saw without being hosed, or any of the bark being taken off before the saw, but to enter the saw about an inch above the surface of the earth, and inclining the saw to run up an inch toward the centre of the root of the tree, cutting it from both sides, that this makes an excellent cut, and all that is afterwards necessary, is taking a sloping slice all round the outside of the root, say inclining towards the centre about two inches broad, and taking it down to the ground. In attending to this you have a very well dressed up stool, nearly formed by the saw itself, which is both speedily and easily done; and in this case there is no danger of loosening the roots by the blows of the axe.

Having thus described the cutting of a natural wood for growth from the first plant, I shall now proceed to consider the method of cutting old natural woods, such as have been cut once or twice, or a number of times, which often require a different treatment.

SECTION VIII.

OF CUTTING NATURAL COPPICE WOODS FROM THE OLD STOCK.

It was formerly the custom, and even at this time some insist on its propriety, to cut trees, intended to grow again, four, five, and even six inches above the surface; but a worse practice, or one that more points out its own fallacy in natural woods, cannot be conceived. When this is done, you will see hundreds of the stools two, three, sometimes four feet above the surface of the ground; and many of them have attained such a size, that the main body of the root is altogether out of the earth, and this root is nourished by perhaps no more than three or four fibres or small roots, and these must, of course, afford a very scanty supply to four, six, or even eight trees, which should be produced and supported by such a stool. Hence we generally find, that trees produced from such a stool, are neither so healthy, nor do they produce the same quantities of bark, or wood, as stools do which have been dressed as they spring up from the ground. Besides, the shoots, for the first year's growth, are so very tender, that if there is a fall of snow during the winter, they must sustain all the weight of the snow, that the whole stool carries, or nearly so, and ten chances to one but they are broken off, and the year's growth completely lost; whereas, when the stools are cut, so as to be dressed down to the ground, the snow can have very little effect on them —the stool bears no more weight than its proportion with the ground. But besides their liability of being broken off with the fall of snow, shoots coming out from a stool from one to four feet above the surface of the ground, never make much progress, nor are they nearly so productive, either as to wood or bark, as those from a stool cut down to the ground; besides, they make a very ugly appearance in a wood. A stool having stood in this way for three or four cuttings, will be found mostly red wood to the outside; and it being only from the bark and sap, or white wood, that the young shoots receive their nourishment, and only in so far as there is sap or white wood in the old stock, does the young sapling cement and become one with the old stock or stool; and we always find that stools of oak in particular, that have most sap-wood, make by far the best and most vigorous growths; the same will hold in pruning off an oak branch, that there is red wood in the wound, which never will cover, and will always leave a blemish in the tree.

It will be found, upon experiment, perfectly evident, that stools dressed down to the surface of the ground, (taking care always not to loosen the bark from the root, or allow it to be peeled off in the smallest degree below the earth, but rounded down level to it,) will send forth the most vigorous shoots and stand the weather, and be the stoutest and best throughout the age of the coppice, and are always the best for layering to fill up blanks.

But to redeem these old stools, I have tried the experiment of cutting off with a saw the old root close by the earth, or I have even cut it away altogether, when, as is frequently the case, one can see between the main root and the ground, and dress up the ends of the fibres or small roots that were supplying the old one with nourishment, and exposing these open to the sun and air. In this case I have often seen, and have had most excellent shoots; and the chances are infinitely greater, and more good will be done in following this plan, than from allowing shoots to spring from the old stock; and from every one of the fibres that was supplying the old stock with nourishment, you will have two or three young shoots.*

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* Many proprietors of natural oak woods, since the first edition of the Forester's Guide was published, have tried this method with overgrown oak stools, and have found the cutting down to the ground to answer the purpose far beyond their expectation; and in place of poor scraggy sickly shoots, have, in one season, had the ground covered with a profusion of fine healthy vigorous trees, even from the roots of very old decayed trees. I have often seen fine healthy young trees reared up from a very old rotten root of the oak, Spanish chesnut, ash and plane, when there was only about one inch of wood remaining round the outside, and also from the old horizontal roots, by laying these bare, as has been pointed out. Should this volume ever fall into the hands of J. R. Smollett, Esq. of Bonhill, near whose seat (Bonhill House) stood the once celebrated and largest ash tree in the three kingdoms, but is now, when I visited it in 1827, fallen totally into decay, excepting a mere skirt, little more than the bark round part of the extremity of the old root

One reason why old stools are apt to get above the surface of the earth is, that, after the first cutting, the stool having sent out two, three, or perhaps four different shoots, which are all to be nursed up to the age of the coppice, and, when they are to be cut, which is the easiest and speediest way for the purchaser, each of these is lopped off with the axe; and this makes a very good stool, and requires little if any dressing up, because the stool, when cut from the plant as directed, and having been rounded at the top, still retains this form, and the shoots coming up around the edges of the stool, by cutting them separately, inclining the edge of the axe from the earth upwards to the centre of the stool, taking care to leave the bark and wood, as if forming one piece, on that part of the stool close to the earth, when the axe is first applied: but let it be carefully noticed, that these must always be rounded down close to the earth.

—were Mr. Smollett to cut this off while it is yet possessed of sap, there would soon spring up a numerous progeny, who, like so many centinals around its basis, would not only propagate the name of their ancient and once magnificent sire to generations yet unborn, but would also hand down to posterity a much more authentic account of the infinite magnitude of their sire, than the page of history, and that too on the very spot where he lived and died. By this means, the proprietor would do much more for the tree than by inclosing with a temporary paling a piece of old rotten stump, which will in a very few years totally disappear.

In cutting in this manner from the old stock, with those there is no more danger than in cutting with the saw, as the root is not now so liable to be loosened as when cut from the plant. This latter method, though it answers exceedingly well for the first or second cutting, after having been cut from the plant, yet it has a very great tendency, in the course of a few cuttings, to raise the main root or stool to a considerable height; and, as soon as the main root raises itself about ten or twelve inches, it should be cut through with a saw, and dressed up in the manner described in cutting from the plant.

I have often seen an oak stool on the face of a rock, having one of its sides level with it, while the other side was perhaps two or three feet above it; and from this latter side the nourishment is more generally received, and therefore the shoots sent out from a stool of this description are in general small,—not arriving, at the time of cutting, at half the size that from a well dressed stool should be expected.

In such case I have tried the following experiment, and have found it to answer extremely well. I made use of the saw, and in the following manner:—I enter it at the higher part where it is level with the earth, inclining it during all its progress downwards, until it comes out close by the earth at the lower side. In consequence of this manner of treatment, I have found the shoots come out from that part of the stool where it possessed most moisture, and receiving their nourishment, as it were immediately from the earth itself, and not altogether depending on the old stock; and it will be seen that these shoots will be found to make as much progress in one year as they formerly did in three. And whereas formerly the old stool only gave out two or three puny sprouts, which, from the weight of snow in winter, and other causes, can never obtain a perpendicular or upright position, but on the contrary come out sloping, and in a horizontal way, always growing crooked; by cutting in this manner, you will have double the number of shoots from the same stool, and these shoots will also be taller, straighter, and stronger, and the stool from the cutting will consequently be proportionally more valuable, at least three times more valuable than if allowed to grow in its old way.

There is scarcely a coppice or natural oak wood in the Highlands of Scotland, but abounds in stools of this description; and by pursuing the plan above recommended, their improvement will be rapid and great, their appearance will be greatly improved, and their value greatly increased. Here it may not be amiss to give the forester a hint, that in cutting an old coppice or natural oak wood, chiefly with a view to its improvement, he be sure to fill up carefully by layering all the blanks; and, if possible, bring it to have a crop of standing stools upon the ground, at eight feet stool from stool; and, if this be properly attended to, there will be an excellent crop by next cutting. Having thus recommended what I conceive to be the best method of cutting and improving old natural woods, I shall next consider the *time* proper for cutting; but as this is a subject which is pretty well understood, a few hints will suffice.

SECTION IX.

TIME FOR CUTTING WOODS.

Every one must know, that if a tree is to be barked, the time most proper for cutting is when the sap is in the tree, and more especially when it is ascending, or as soon as the bud begins to make its appearance, which, if the spring be favourable, will be in the end of April, or beginning of May. Birch and larch woods are also peeled, as their barks are used in tanning, but these will peel nearly a month earlier than the oak. Should there be no frost, birch and larch may be peeled about the beginning of April; but the birch is commonly allowed to stand till July, and the peeling of it is commenced after that of the oak has been completed; and for this reason, that there is an outer skin upon birch bark, which requires to be taken off, as it is of no use to the tanner, and renders that part which is of use more difficult to grind with their bark mills; and the month of July, or even August, is the only time at which the two barks can be separated with ease, as at this time the juice or sap has made its circulation through the tree and bark, and this circumstance renders the separation more easy.

From the beginning of May to the middle of July is the usual time for barking the oak. The earlier in the spring this operation is performed on the oak, both for the growth, if a natural wood, and for the bark, the better. When the sap has begun to rise, the bark will easily be detached from the wood, and it ought then to be taken off without loss of time; and if the whole could be taken off before the leaf is completely developed, the bark would be better. After the sap has arisen to the leaf and new growth, the bark becomes more dry, and requires more beating to separate it from the wood. And when what is called the black sap is descending the tree, the bark taken off is black, and loses its original colour; and at this time also the bark begins to throw off a scurf, more especially young bark without much cork on it; this outer skin having less of the proper sap or juice, and being much drier when taken off, will weigh less, and consequently will not be so valuable.

If possible, oaks should be barked by the middle or end of June; but this, when there is a great extent to be cut, may be impossible, though it is equally disadvantageous to the proprietor and purchaser to cut and peel after that time, as every ton of bark taken off after the 1st of July will be deficient two cwt. per ton, compared with the same quantity taken off in May, or early in June.

The time of cutting is generally fixed for the 15th day of July, and after this date there should not be a single stool of oak wood cut that is intended for the growth; and as soon as possible after the 15th, the whole of the wood and bark should be carried away, that the young growths may not be disturbed or injured, as at this time they will have made considerable progress; at any rate there should neither be wood nor bark remaining within the new cut hag after the 1st of August; nor should either horse or cart be permitted to enter it after that period.

I know the time allowed for cleaning and clearing out woods, and removing wood and bark, is generally extended to Martinmas, and sometimes even to

Candlemas; and, where there is much to be done, it can scarcely be completed before Martinmas, or middle of November.

It would be advisable for the proprietor to assign some spot of ground in a corner of the wood, or, what would be preferable, some place distinct from it, to the purchaser, in which he shall stack up the bark, if it be determined that it should remain for any length of time after cutting. To this place also he ought to remove the wood; for, as I have already said, these remaining on the ground will be apt to disturb and injure the young growths. It is well known that trees, and oaks in particular, after the beginning of August, make what is termed a Lammas growth, and the future prosperity and health of the coppice in a great measure depend on the first year's growth, as far as regards form and vigour of the shoots, as will be shown in Section X.

Let it be carefully kept in mind, that as soon as the wood and bark are removed from a natural wood, the fences should be thoroughly repaired, to prevent sheep and cattle from entering; and, even from the time of cutting, particularly after the growth has made its appearance, horses should not be allowed to go at large in it, while brought thither for the purpose of removing the wood and bark. It is a well known fact, that cattle, sheep, and goats, do more damage to young plantations, and more especially to young natural oak woods, than can well be imagined or described. One would think that those who do not keep cattle of every description out of young natural oak woods, do not wish to see them thrive. After the 1st of August, when the cutting shall have been finished, and it is proper, as before stated, it should be so, the gate should be locked, and the wood as completely secured as a man would his desk, into which he had put his money, to preserve it from thieves.

It is difficult to say at what time cattle should be permitted to enter these woods to pasture. Some have stated five years as the proper time, others eight; I, however, differ from both. I have no hesitation in saying, they ought not to be put in till the natural wood shall have attained at least ten years, for the above reason, among many that might be stated.—I suppose, as I recommended, that all blanks which occur in the coppice, are filled up either with young oaks, or by layering; or if none have been planted, still there are seedlings springing up, which may come to be fine trees, and which ought to be preserved.

In natural wood of old standing, there is generally a quantity of what is termed, in Scotland, black or barren wood, (such as ash, plane, birch, elder, &c.) and these are not cut until after the oak is all cut and barked; and cutting and removing it from among the young growth of oak wood does more damage to the new cut hags than they are worth: it is, in truth, a practice destructive and awkward. Here the purchaser makes use of an excuse, and throws justly all the blame upon the proprietor himself. "Why, yes," says the purchaser, "I know it is the source of much injury to be cutting and removing the barren wood, after the oak growths have made such progress; I bought it and must have it out; this wood was not exposed to sale till late in March, (or April, as the case may be;) I did not become the purchaser sooner, and it is impossible I could have it all cut down before the oak was ready for peeling; and during the time of cutting and barking the oak, from which I am to derive the principal part of my income to pay the stipulated rent, I could not attend to it." He will argue, if there be any part of it more particularly valuable, "It was not then the season for cutting wood of this kind; that it ought to be cut early in the spring or autumn, and the thing must be done whatever destruction it may cause. I am perfectly aware I am bound by the articles or conditions of sale not to injure the young shoots: but here is a large stool of five or six ashes, elders, or birch, &c. surrounded on every side by fine stools of oak, and these have five or six shoots, some of them two or three feet long, but I must have away these birches, ashes,

&c. and I must have a fall to them. I cannot take them on my back as they stand, and carry them out of the wood."

The purchaser sets the cutter to work: he fells one; it falls right into the midst of an oak stool, and breaks off all or the greater part of the shoots; another falls in an opposite direction, does the same, and so on till the barren wood trees shall have destroyed as many, if not more, fine oak stools than all their value, and which most probably make all that cutting a mere blank.

To remedy this evil, the proprietors of natural woods, who intend to sell, should put these woods that have a great proportion of black wood in them to sale, if possible, in autumn, or if that cannot be done, they should not be sold later than January or February, and binding the purchaser to cut down all the black or barren wood, before beginning to the oak; and to have it carried off along with the oak and bark, giving him a reasonable time to fulfil his engagement: if the whole is oak, they may be sold any time before the 1st of April.

This mode of selling natural oak woods, where the quantity of barren wood is great, can be attended with no inconvenience to the proprietor; for the price of bark is never positively known for the ensuing season, nor indeed till some time in May; and in valuing these woods, either for sale or purchase, the calculation is made from the prices of the same kinds of wood and bark so sold the last season, unless there is some evident apparency of a rise or fall in the prices of wood and bark, from which certain circumstances are expected to take place. An early sale is also in favour of the purchaser, and he will be inclined to give a better price, as he has sufficient time to look out for the most proper workmen, and has every thing in perfect readiness to commence the barking as soon as the bark will rise, and of course finish his barking in proper season. On the other hand, if he does not make the purchase until April, if he has 100 or 150 tons of bark to peel, he requires to procure 100 hands, or more, and perhaps has to provide tools; and if the quantity be more than he is accustomed to have in his possession, before he is aware the season is advanced, he loses perhaps the first fortnight, and probably the month of May has passed before he has proceeded any great length; he sees he must now hurry on, and gets confused; at any rate he is obliged to peel for a fortnight or more, longer than he ought at the end of the season. In this case both he and the proprietors are losers. I would therefore recommend the sales of natural coppice woods, on no account whatever, to be at a later period than the month of

February, particularly if there is barren or black wood to be cut.

SECTION X.

THINNING AND PRUNING NATURAL COPPICE WOODS.

THIS is a part of the forester's work that ought to command and occupy his most particular attention. The time to begin to thin these woods, say some, ought to be the third year after cutting; others say, five or six; and this is the most general time throughout the Highlands of Scotland, but particularly in Argyleshire, which abounds with natural woods, and beautifies, in a most superb degree, many sides of the barren mountains in that country, particularly about Inverary and both sides of Lochfine, as also all the lochs. Some are not for thinning till they arrive at eight, ten, and twelve years of age, but nothing can be more destructive and absurd than this. These newly cut stools, the very first year, that is to say, immediately after cutting, or as they may be called, the Lammas growth,* throw out from many of them ten and twelve different shoots, and some of them come up like a handful of grain thrown into good ground, or like a bush, covering the whole stool. This, say the advocates for ten and twelve years growth before thinning, is nature's own work, and all should grow together for these years, and then the thinnings will pay the expense of thinning. Those, again, for thinning at three and six years growth, say that, as the tree when cut was in the most thriving and healthful state, the root retaining its sap, and having little to supply now besides what it formerly had, it, of course, is able to supply abundantly all the new young shoots that come out from it, and they ought to stand for at least three or more years, and then it will be well seen which are the properest shoots to live. I grant that it is nature's own work to throw out all those shoots from a newly cut oak root, and I grant also that nature is ever kind to her own children; but nature may be overburdened, and she is effectually so in this case; and I say it is impossible for a tree root, which is perhaps only ten inches in circumference, or say even twenty inches in circumference, and few are this size, to cherish or nurse up, with any degree of health or vigour, ten, or even twenty young shoots or trees, either to three, six, or ten years, without the tares spoiling the wheat, or the lean cattle eating up the fat, as the one must be evidently spoiling the other; so that the whole crop is much spoiled and lessened in value when it comes to the axe, by want of early thinning. Therefore every natural wood, the second year, should undergo a thinning, that is to say, it gets all the Lammas growth, as it is called, the year it is cut, and then allow it all the next year's growth, when, any time after, from the month of October to the first of April, let the whole wood be gone through, and clear or take away all the growths or young shoots, excepting those you are sure of coming forward to maturity, leaving, at this time, one or perhaps two shoots more on every stool, than what it may be supposed able to nurse up to the full time of cutting. Great care ought to be taken at this time to divide the shoots, that are to remain, equally, that is to say, to have them at as equal distances from one another, round about the stool, as possible; at the same time, not leaving on any stool, unless a very large one, and that too in an open part of the wood, more than six or eight shoots. This will be found to be as much as any stool can nurse up to the usual age for any purpose. By this early thinning, you have it in your power to leave just such a crop upon the ground, or rather upon your stools, as you are sure nature is able to cherish and nurse up, without overburdening it. At this early period of the thinning, too, you can do it easily, without in the least injuring the shoots that are to remain, as it can be readily done with a short knife; but the newly invented instrument for thinning natural stools will be found much more handy, and will do it more speedily, safer, and to better purpose, which we may term the Coppice Thinning Chisel, (see the plate,) cutting them off close to where they came out from the stool; and at this time, too, you have an excellent choice of shoots. By your being three or more years in giving the first thinning, you must have recourse to a pruning hand-bill; by which means, if in the hands of an inexperienced person, the proper shoots are often hurt; and, besides, when taken off at this age, the bark is often loosened from off the root, so that worms and other injurious animals get in betwixt the wood and bark, which sometimes proves fatal to the whole stool. I would therefore recommend early thinning, as I have found it, in the course of my experience, to be the very life of a natural wood.

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* All oak trees, when young, but particularly when springing from the natural stool, advance with great vigour, and make every year two shoots, one in the month of June, and the other commencing in August, called the Lammas growth, which usually continues to grow till the frost stops it in the end of Autumn; and this is always the most valuable growth for natural oak coppice, and ought to be particularly taken care of.

All natural woods make either less or more progress the same year they are cut, that is to say, if the cutting is finished on or before the 15th of July. The stools cut in the months of May and June make most vigorous progress. To give one example here, amongst many that might be given—I was engaged at an oak wood-cutting, in 1818, on the estate of Fotheringham, in Forfarshire. This was cutting from the plant, in order to turn it into a natural coppice wood. We only began cutting the oak on the 18th day of May, and towards the end of July I measured three several growths, from three to four feet long, and by the middle of September, from six to seven feet long. See also the growth mentioned in the Introduction, on the Airthry Estate. I grant those were very extraordinary growths, but I have often witnessed nearly the same in many other places. And who would not say but that these should be encouraged, and allowed every chance of coming forward, by taking away at once all superfluous growths from the stools, that they may get all the sap and nourishment possible, as it is well known that every green blade must be supplied with a part of sap or juice from the main root? Having thinned them the second year after cutting, little more will be necessary for some time, unless to go through and prune a little; at the same time keeping down all young suckers from off the stool. Here it may be very necessary to observe, that the value of coppice woods chiefly depends on the quantity of bark produced from them, and the more branches consequently the more bark; and some argue there should be no pruning at all. Let it be here observed, however, that the wood of coppice, properly trained up, at the age of twenty-four years, may be of considerable value; and its value chiefly depends on its tallness and straightness; because, if the timber of a coppice wood, although thick enough for many purposes, if very crooked, is almost of no value but for fire-wood. I consider it, therefore, very advantageous for a coppice wood to go regularly through it the second or third year after being thinned as described, and prune with caution all those shoots you think will remain to the full time of cutting, pruning them up from the root, and taking the most of the twigs off that side of the main stem that inclines to crook, in order that it may be drawn up in as straight a position as possible. This will be found to be of very great advantage to the cleanness, and also in aiding the straightness of the timber of a natural coppice wood. Those stems you left when thinning, supposed to be taken out at half time or sooner, ought not to be pruned, but allowed to grow any way, and as rough as possible, taking care, however, that they are not interfering, or in any way hurting the main stem that you intend to carry up to full time. If you find any of them that were thus left taking too much of the juice or nourishment from the main stem, so that the whole is getting sickly, then they ought instantly to be taken away; and see that there is no more left than what the main root is able to nourish up. I said two more may be left at this time than what the substance of the root will bring forward to full time; but this will depend a good deal upon the soil, &c. &c. and the healthiness of the shoots. It is not to be understood that any shoots are to be left on the stools for cutting at half age to the injury of those to be reared up, but only where it can be done with propriety, as aforesaid.

Having thus thinned during the second, and pruned during the fourth or fifth year, little more will be necessary now till the tenth or perhaps the twelfth year, when the whole should be gone over, by taking away those stems that were left as a kind of nurses to the main ones. Here it is difficult to say how many should be taken. Some stools may do with all the six, others with five, others with four, and some only with three. In the first place, care must be taken to leave no more than what you are sure the stool will nurse up to the full age intended for the coppice, as the stronger the shoots become they always require the more nourishment. It will now easily be seen if any of those shoots are receiving sufficient supply of nourishment; if they are not, they will become stunted in their growth. Those, therefore, ought to be taken away, and likewise those that are wholly overtopped, and are not likely to get forward to any kind of maturity during the age of the coppice. In the second place, it will be necessary here, carefully to look round the bottom of the stool, and if the stools are thick upon the ground, take the most from those sides that seem to press most upon one another. At the same time, it may here be observed, that a natural wood is not like single trees training up to maturity; they will thrive well although pressing a little upon one another, if it be not so as to hurt each other; that is, the one altogether overtopping or bearing down the other to its hurt; but they are the better for being a little pressed sidewise, as it has a tendency to cause them to grow more upright, and of course more straight. The thinning we are now attending to ought to be done in the barking season, and the bark peeled off what is cut, and preserved. This will be found to do something more than pay the expense of thinning. Being done, however, at this season, the bark of the remaining shoots will be very easily hurt, as also the bark of the stool; therefore the greatest care is necessary that neither of them be injured. I have always in this case found it a very great saving, in place of an axe, to use a very narrow ended hand saw, one that will go in betwixt the shoots, and cut the one to be taken away easily out, without in the smallest degree injuring either the bark of the stool or the remaining shoots. If the saw is kept in proper order, it will be found more speedy than the axe; but in place of the saw, use the newly invented thinning chisel.

I have often found it of great use to go through a neglected coppice wood, one that had never been properly kept, even at the age of twelve or fifteen years, and dress it up in the manner described; and have been very sensible of their making more progress in one year, after having been thus dressed up, than before they did in three. So that I would recommend to all those having the charge, or coming into the charge, of natural woods, although they have been neglected until they are at the age of even fifteen years, to go through them in the way directed; and I doubt not but what they take out will pay more than the expense attending it; and I am convinced, that at the end of twenty-four years, say nine years after, they will have a third, or nearly so, of more bark on every acre, and the timber will be considerably improved, and of much more value. It has been objected to by those advocates * for ten years before any thinning takes place, that to do it any sooner would cost a great deal of expense, and nothing for it, whereas now it will pay the thinnings: the advantages of early thinning has already been pointed out, which answers this objection. The expense of the early thinning is very trifling. I have had a man under my charge that has thinned regularly every day upwards of 150 stools, or about one thousand in a week. Now, say the stools are about or nearly eight feet distant from one another, which they ought to be, a man does an acre in a week, for which perhaps he receives fifteen shillings; but by the new thinning chisel, a man will do four times the above number; now, the next thinning, at half age, or thereabouts, of the coppice, is so very superior to what they would have been, had every thing been permitted to grow, that this thinning pays itself and the former thinning with in-

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* The natural woods in the Torwood, in Stirlingshire, are of very ancient date. The *Upper Wood*, as it is called, the property of Colonel Dundas of Carron-hall, was (until about fifteen years ago, when Mr. Alexander Mills got the charge of it,) like a wilderness, and many acres of fine natural woodland would not produce one ton of bark; but, by Mr. Mills's exertions in carrying on a system similar to what is here laid down, these very acres, by cutting-time will, on an average, yield from five to eight tons of bark. The manner that these woods, under his charge, are thinned and kept, does him much honour, and is worthy of the forester's imitation

terest, and the wood is twenty-five per cent. better at the end. By the system of late thinning, I have known many stools irrecoverably lost. That thinning a neglected coppice wood at the age of fifteen years will be of advantage to it, take the following example. I requested a proprietor of oak coppice woods in Stirlingshire for leave to try an experiment on two acres of neglected coppice at the age of fifteen years. The wood contained about thirty acres, which had been all cut in one year; with the consent of the proprietor, and assistance of his land steward and forester, we selected and measured off two acres as near a-kin to each other as it was possible, and so similar in growth, &c. that not the least difference was perceivable betwixt them, a halfpenny being tossed up which was to be the acre thinned out; one of the acres was immediately thinned, leaving three or four, and not exceeding five shoots on any one stool; the thinnings were barked, although it was, of course, as should always be done, the unthrifty and dying shoots were taken away, still there was from the thinnings one ton two hundred weight of bark, which brought only about L.11, the bark was not the best in quality. The two acres were allowed to grow in this state for nine years, till the age of twenty-four years from cutting time; and it is a notorious fact that the acre thinned out produced near a fourth part more bark than the acre not thinned, and the bark too of better quality, and the timber of the thinned acre brought near double the value of the other, as many of the shoots were fit for cot-house purposes, and not a few for spokes. This shows at once the propriety and advantage of thinning coppice woods, even although neglected to a considerable age. But it is the greatest loss and folly imaginable to allow natural woods to come to this age before being thinned, as the growth of the whole is injured, and of course loss produced; but when such has been allowed to stand too long still by giving them a thinning, they will be found both profitable for the present crop and advantageous for the growths in future, by having fresh healthy roots when cut over to rear the new growths from.

SECTION XI.

OF CONVERTING A COPPICE INTO A STANDING OAK WOOD, AND OF LEAVING RESERVE TREES IN IT.

It has been, and still is, an objection with many, that when a wood is once cut over, and become a natural coppice wood, that it must for ever remain so, as nothing more can be done with it but to cut it over every twenty-five years, or thereabouts; and should a time arrive when there is no great demand for oak-bark, this wood must at all events be cut down, and brought into the market under such disadvantageous circumstances, both as to the prices of bark and of wood, as may occur. But this is false reasoning, as there is scarcely any soil that carries natural oak wood to the age of from twenty to thirty years, but will also carry trees forward to full maturity, if rightly dealt with for that purpose. If it be, therefore, thought proper, either from the local situation of the wood, where it would be more profitable to have full-grown timber, or even for ornament, to rear them up from the stools to maturity;—supposing the stools have been dealt with as directed in the foregoing section, to the age of twenty-four years, or thereabouts, and it being thought now more advisable to bring as many of them as possible to be large trees, it will then be necessary to cut over about a third part of the whole stools, and at the same time to dress up the stools as directed for the growths, as these must now be reared as underwood; then to thin out from the stools untouched, which will now be about twenty-four feet distant from each other, taking the worst of the shoots, leaving on an average at least three shoots on every stool; and these must be the best and healthiest of the shoots or stems; at the same time pruning them up with particular attention, taking most of the sprouts from off the inside of the stems of the remaining shoots, pruning them up from the middle of the stool, taking the inside shoots towards the top. Having now plenty of room to spread out on all sides, they will do so with amazing rapidity. As the under coppice cannot be expected to make such progress as when the whole is cut down, it will be also necessary, the second year after cutting, to thin those stools, so as to leave from six to eight shoots on an average on each of them, allowing them to grow in their rough state, without any pruning, as they must now be cut away every fifteen or twenty years, chiefly for the bark, and kept as underwood. At the first cutting off of the under coppice wood from amongst the large stools, as they will now have made very considerable progress in size, they will require a little more room, and may at the time, say fifteen years after being left, when the under coppice is cut, thinned out, to about 30 feet distant from each other. This is by far the most profitable way of rearing oak woods: if any of these left misgives, new shoots must be trained up as trees to supply their place from the underwood stools.

In order to have large trees in any plantation, they must be thinned out at least thirty or thirty-four feet distant from each other; and here, on an average, you have only about sixty trees on an acre; whereas, from the natural shoots you have three times that number, and their growth is much more rapid than from the plant. In this case each acre of natural oak trees, nursed up to seventy years of age, will contain about 180 trees, which will average at least thirty feet each tree, making 5400 feet, say at 4s. per foot, including bark, (which is but a low price for such trees,) makes L.1080 Sterling per acre, or upwards of L.15 per acre per annum, besides all the under coppice wood, which will all along have done a great deal more than pay a fair rent for the land. Some will be ready to object, and say that trees will not grow to these sizes, three out of one stool, within the compass of thirty feet. I could here give many instances of this that have come under my own observation; but the following may suffice, which must have commanded the attention of every traveller; and every one who is delighted to see the bulwarks of our nation in a flourishing state, must have stood still to admire it. This oak stool I refer to, is on the estate of Touch, in Stirlingshire, and grows close upon the side of the public road leading from Stirling to Dumbarton, between four and five miles from the former place, where there are to be seen three trees growing from one stool, the least of which contains about forty solid feet; the three added together making on an average 150 feet, and not occupying more than nine feet of ground any way; and this natural stool of oak is not more than from seventy to eighty years of age. On the opposite side of the road, at the same place, is a single oak tree, from the plant which I am informed was one of the reserve trees in that coppice. When this stool was cut, it must have been of very considerable size at the time, as the tree does not measure more than half the contents of the natural ones put together, and occupies a great deal more ground than they do. There are a great many more natural oak stools on the same estate, near the house, not much beyond half the age of the above tree, that have three, four, and five stems from them, and will average thirty feet each stem. Need I here also call to the attention of my readers the admirable and magnificent natural stool of oak growing on the public road, I think on the estate of Closeburn near Aldgirth Bridge, within a few miles of Dumfries, which is admired by every traveller, and is also from a natural stool of the very kind I have been describing.

Allow me to give one more instance. There is a natural stool of oak on the farm of Bareside, estate of Touchadam, the property of William Murray, Esq. This stool has seven stems growing from it. One of these stems, which has been over-topped by the others, on account of their never having been properly pruned up, has become dead, though there are still about three solid feet in it; the other six stems are really each of them large and magnificent trees, and on account of their having been left entirely to Nature's own care in rearing, their main stems are extremely short to what they might have been, had they been timeously pruned up, but they are remarkably well adapted for ship-building, and each of the six stems would make timbers and knees for a vessel of from 160 to 180 tons. The six stems put together measure no less than 180 solid feet; and as there are more branches on this stool, in proportion to its measure, than on the one before alluded to on the estate of Touch, of course it will produce more bark in proportion to the number of feet. It may be observed, that from the great value of the crooks of this stool, it is well worth 5s. per foot, including bark, which, for 180 feet, is L.45 Sterling. From the way that the stems of this stool have been obliged to spread, it covers a great deal more ground than the one referred to; yet an acre of ground would be very capable of carrying forty such stools as this, which would be no less than L.1800 Sterling per acre; and, I am informed, this stool is not more than seventy-five years of age: this is no less than L.24 per annum per acre; and I have no hesitation in saying, if my information is correct, that, from the poorness of the soil of this farm, two acres of the under coppice woods would have paid the proprietor annually, all the rent he has received for this whole farm for seventy years past. This magnificent stool of oak grows not more than a gun-shot south of the public road leading betwixt the villages of St. Ninians and Cambusbaron, and not more than one mile and a half from the town of Stirling, and at that distance it only appears in the eyes of the traveller to be a mere bush, though its large spreading top appears most beautiful; but how pleasingly deceived he is when he approaches within the cover of its spreading branches, and beholds not a bush, but stems fit for the principal timbers of a large ship, and that too one of Nature's own children, nursed by herself, as it is plain no attention had been paid to the rearing of it, and that too from the poorest part of the soil. It is customary to leave standers or reserve trees amongst coppice, but when it is intended all to be cut over, it is rather hurtful than otherwise to the under growths. It may, however, sometimes be necessary, for the sake of ornament, &c. to leave a few of them, and these ought to be the straightest trees, and, at the cutting of the coppice, they ought to be particularly pruned up, especially if those left are seedlings, or from the plant; and the tops of them ought to be a good deal lightened, so that the wind may not blow them down, nor shake them too much, so as to loose them at the root, as it causes them to lose the growth, which is often the case if they are left in very exposed situations. It is very proper, in all coppice woods, to refrain from cutting all young seedlings at and under four inches circumference three feet from the ground, as those will come forward to be good trees by next cutting, and may perhaps supply the place of old stools that have been hurt in cutting, or that may be on the decline from some other circumstance.

After giving these examples amongst many more that might have been given, the reader will readily see, that it is not only a very easy process to turn a natural coppice wood into large trees, but that it is the speediest way of rearing oak trees, either for valuable purposes or for ornament.

In the first and second editions of the Forester's Guide, it will be seen that we there considered the leaving reserve trees amongst oak coppice was detrimental to the prosperity of the coppice, and that few or none should be left but where they were required for ornament to keep up the look of a plantation, experience has so far altered my opinion, especially where profit is the sole object, and I am now confirmed in the opinion that to leave a certain number of standers in each acre of natural cut oak wood is the most profitable, as will appear from the following system, when attended to. I may observe, by the way, that large timber trees can only be reared with propriety and advantage in places where it is easy of access for removing them, as in many places in the Highlands of Scotland, and also where oak coppice wood may be grown with advantage, as the timber and bark at twenty-four years of age can be easily removed from dens and numerous places where it would be impossible to remove timber trees but at an expense of their whole value. In all such places, then, where timber trees can be brought to a market, or a shipping place, (for when once shipped, sixpence per foot, or less, will carry it to almost any part in Britain and Ireland,) at from sixpence to one shilling and sixpence per foot, it will be more profitable to have reserves in every coppice, cutting in the following order, say forty trees or standrils left in each acre at first cutting, this will be about thirty-four feet apart each standril tree, which, to the age of forty-eight years, the second cutting, will not be too many. These standrils, in Scotland, amongst foresters, are technically termed two year olds; these will be worth, at least, in forty-eight years L.2 per tree, but twenty of these standrils are to be reared up to seventy-two years, say three year olds, which at this age will be worth at least L.5 per tree, wood and bark. See the following

STATEMENT.

20 Standrils, three year olds, at L.5 per tree,	L.100
40 Standrils, two year olds, at L.2, . .	80
One acre of ordinary good coppice, at 24 years old, wood and bark, after paying the expense of manufacturing, is often worth more, but call it, . .	60
	L.240

The price of the standrils may and will vary a little, according to their locality to a market or sea-port. Supposing a proprietor to have only 100 acres of land turned into coppice oak, and divided into annual cuttings, brought into the above state, he will have upwards of four acres to cut yearly, which will bring him in above L.960 Sterling yearly rental for four acres of land; or should he at any one time require a sum of money, by selling fifty acres or more, he can realize L.10,000 at any time, and that off a crop of a few acres. The reader will be pleased to observe, that to cut forty reserve trees every hag, say twenty-four years, there must be eighty left, but then there is never more, by the above plan, than twenty left to stand longer than two years old; therefore, if the coppice is good, and ordinary good soil, it will not be overburdened by the above method, always making a choice of such trees as will do least harm to the coppice. See this explained more fully in Plate XVI., where Figure 7. represents a timber tree, suppose a four year old, to have been left round the outside of the coppice hag. Wherever this can be done, a few of these should also be left in addition to the above standrils, and reared up to four cuttings, the size of which trees will answer for all valuable purposes, some of which may be regularly reared, and cut down with the annual cutting, which will very much add to the value per acre, without in the least diminishing the value of the coppice.

It is as notorious a fact as the sun at noon day, that throughout most of the counties comprising the Highlands and the south of Scotland, particularly the whole of Argyleshire, that there are millions of stools or roots of oak, and some other kinds of trees detached throughout almost the whole of the extensive fields now appropriated to sheep pasture; nor is this to be wondered at, when we consider, that many thousands of acres of land that were formerly carrying natural woods, have of late years been left uninclosed, and set aside for pasture lands. It is no less wonderful than true, that the growth of these stools or roots, though devoured and eaten up in winter by cattle and sheep, are never wholly extirpated. As soon as the grass gets up so as to afford a supply of meat for the sheep, &c. the growth gets up, and so soon as the grass fails, the growths or saplings are eaten up.

Now were these dressed up from the old root or stool, and inclosed singly, many a beautiful and truly valuable timber tree could be reared, as these stools send out most rapid growths. The inclosing would only be required for two or three, or not exceeding four years, when their tops would be totally out of the reach of cattle or sheep. It is a fact that sheep are always detrimental to trees, but when once the natural growths of oaks, &c. are out of their reach in the tops or lower twigs, there is no danger of their not becoming timber trees. The method of inclosing all detached stools of this kind could be most effectually done by my portable or twisted larch fir paling, as the stobs and bolts of the portable paling could be easily carried from one stool to another as they are required, or wherever there are larch firs, four or six stobs of larch, and these twisted up with the small loppings of the larch, will be found to stand as long from the first putting up as will be necessary, and this will cost a mere trifle. For example,* there is on two farms in North Knapdale, Argyleshire, the property of Neil Malcolm, Esq. of Poltalloch, taken from actual survey, 40,000 uninclosed oak, and 20,000 ash stools, the whole not worth at present L.300

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* This is also taken notice of in Miscellaneous Reports, &c. No. 3.

Sterling, nor will they ever be worth much in their present unprotected state. Were these thinned out for standing timber trees in such a manner as already described, viz. by taking away all the radical or unthrifty shoots, and leaving on them one, two, or not exceeding three, of the very best, healthiest, and most thriving, and those most likely to become trees, such as were pointed out or particularly described to the forester as we went along, and on such of the stools as have comparatively no shoots from them, having been eaten up by the sheep—were such dressed properly up for the growth before inclosing, a very few years after being inclosed will put them completely out of the reach of cattle; and if this is properly attended to in the way and manner already described, in twenty years after these very stools will be worth at least L.50,000 Sterling, in from fifty to sixty years worth L.150,000 Sterling, timber and bark. Observe, as the old stools or roots are large, there will be three trees on an average reared up to maturity, as timber trees, from every stool; besides, these trees will still be increasing in size for two centuries to come, which, notwithstanding their ornament and increase in value as timber trees, will cover the nakedness of the country. Let every unprejudiced person the least acquainted with that country anticipate the infinite grandeur and beauty such trees will add to the whole country, and to the prosperity of the proprietor of these farms, nor do they take one inch of ground from the farms, as by clearing away the rubbish, and confining the stools into two or three shoots from them, there will be the more growth of grass. I suppose on these farms there are not above four trees to an acre; still small as this number is, three trees on an average can be reared on each stool, so that in a few years the trees will be worth much more than the proprietor paid for all the lands. It may be worthy of observation here, that the whole of these trees could be gained by about an outlay of L.50 for men thinning, dressing, and inclosing. I may also observe, that the wealthy proprietor has an immense number more on his extensive properties in that country, and has set about these and other improvements with spirit and life. I beg to add, that a great quantity of excellent timber trees could in this way be here reared up for the British navy. None that ever travelled from the head of Glenshirea to the farthest part of Kintyre, or from Inverary to Campbelton, without going one inch off the road, but must have seen thousands of such stools; and if such a quantity of timber can be reared, and a vast sum of money realized from a few stools, thereby yielding so great a profit to one individual, what would be gained to numbers by attending to it on the same extent; and this is but a small portion to what I could mention; and all this, I had almost said, within a rope's length of where vessels could take the timber and bark of them on board. I have often been surprised at the supineness of many of the proprietors in this part of the country, especially those who almost at a nod from them, so to speak, could rear up such properties to themselves and their posterity, ornamental to their estates, and embellishments to the whole country. And my surprise is the more, having had the honour to be on many of their lands, and above all things, with my tongue and my pen impressed on them this easy and profitable improvement. I hope and trust this volume will help to awaken them from the strange lethargy in which they have been enveloped for so long a time. The wealthy proprietor, whose farms have just been mentioned, has an extent of land little short of forty miles from Eriden Lochaw to Castle Sween, and were that gentleman to offer me a choice of the woods on the woodlands, or the rental of these farms for seventy-two years, with liberty to take in the uninclosed stools of wood on these farms, I would take the woods; and by this means I would insure to my posterity, at the end of seventy-two years, a sum of at least

L.500,000 Sterling from timber trees on these lands, and have annually a good living from the three coppice cuttings; nor would this take one acre of land off these farms, nor one shilling of the present rental. Immense as this sum is, it need not excite surprise, nor stagger the belief of any, as every one the least acquainted with that part of the country, will at once, after taking but a superficial view of the grounds, pronounce it quite possible, and not at all exaggerated.

SECTION XII.

TRIAL OF A NEW METHOD OF THINNING NATURAL WOOD.

This new method is founded on an experiment I made in 1810. At this time I tried only six stools of oak, which I particularly marked in the wood. I visited them every year regularly for four years after, and found them doing extremely well. I saw them again in 1819, nine years after the experiment, and found them doing equally well with the best stools in the coppice, and far superior to a great part of it. I have, every year since 1810, tried the same experiment with more or less in number, and have all along found it to succeed extremely well, and in many instances far outstripping any stools in the rest of the coppice, and they had no occasion for the least thinning, nor the least attention being paid them; but I have not yet lived to see a second cutting of any of them, nor am I as yet perfectly assured whether or not it may not be detrimental to the root or stool after next cutting, although from their healthy appearance, now nine years after, I would hope not. I shall submit the experiment to the reader, and those managers of woods who have it in their power to make trial of it, and should it succeed, it would save a great deal of expense and trouble in training up coppice woods.

The plan is this: Immediately after the tree was cut, and the stool dressed up, I went through and selected a few stools, for the purpose of trial. The first stools I pitched upon in 1810 were cut from the plant, and the diameter of the least was eight inches, and the largest not above twelve, making 24 and 36 inches in circumference. These stools I divided, some into eight and others into twelve parts, and with a peeling-iron I took off from some four, and from others six parts of the bark, pulling it down below the earth, and taking it completely off the root, taking care not to loosen the other four and six parts of the bark from the root, but leaving it perfectly entire at equal distances round the root; and from every one of these stools, which I have tried in the way described, more or less every year for these nine years past, not one stool out of ten but what has sent up fine healthy shoots from that part of the stool where the bark was left; and many of these stools I can at this day point out in the most thriving condition; nor have they ever required thinning, as they just throw out such a number of shoots as there are pieces of bark left on the stool: and I can add here, that I have tried the main bodies of the stools, and have found them to be as full of sap as those stools having all the bark left on them. Should this method succeed in after-cuttings, of which I have now little doubt, what a vast improvement it would be, and what a saving! One man going after the cutter, could prepare at least a hundred stools every day, and the wood would require nothing more till once it came to the axe again.

I hope these few hints, which are dictated by experience, will induce an early trial to be made by those who have it in their power; nothing can be lost by it; as at first the trial may be made in stools which it does not signify much whether they are lost or not. Those taken should be such as are in places where they can be spared; but at the same time doing it justice by using a thriving stool. The stools thus thinned in 1810 are still now, 1824, in as thriving and prosperous a state as any of the stools in the coppice, and there is not the least appearance of the stools having suffered the least injury from the parts being peeled. I have visited many of the stools referred to now in 1827, 17 years after the first trial, and find them still healthy, and many of them better growth than those otherways thinned. The bark in the most of the stools when it was peeled off, having grown over, and the whole stool as fresh and vigorous as any in the coppice.

SECTION XIII.

OF EXTIRPATING BARREN WOOD FROM OAK COPPICES.

The natural woods of old standing used very much to abound with what is by foresters called barren wood, such as birch, elder, willow, hazel, and the like; and indeed great quantities of these are still to be found on good land, perfectly capable of carrying fine oak.

About ten or twelve years ago, when oak bark was selling at from L.18 to L.20 a ton, the proprietors of oak woods began to see the advantage and propriety of having, if possible, all their natural woods of oak, and where what is called the barren wood was growing, it was extirpated, or kept down, and oaks planted in its place. The only way of keeping down these kinds of woods formerly was, every spring before the growth was far advanced, men went through the woods with axes, and cut off all the shoots that had made their appearance during the preceding summer; and this had to be repeated annually during half the age of the coppice, which was a laborious work: and even after all this, many of the young plants were choked with this kind of stuff; and besides, it never was fairly rooted out or extirpated. About eight years ago, I fell upon the following plan, which, in my experience, and the experience of every man who has followed it, has been found to answer the purpose most effectually. The plan is this: if you have any of those trees which you want to extirpate, let them be cut in summer, when the sap is in them. You may do so along with the oak, or at the time of peeling. After being cut down either with an axe or otherwise, a person must be sent through with a peeling-iron, and made to peel all the bark off round and round the root, considerably below the surface of the earth—to the bottom of the root or stool if you can, and the iron will easily do this; at any rate, be sure it be taken off all round the root, and completely under the surface of the earth; and this, if properly done, will be found effectual, and that too once for all, for it will require no more work to keep it down, as all further growth or vegetation in the shoots is by this plan effectually checked.

I could mention many woods where large quantities of birch and elder, and other woods, have been extirpated from amongst oaks in this way; and the expense of doing so at the time is very trifling, and then it requires no more work to keep them down afterwards, as they are in this manner, as already stated, effectually destroyed. And when the wood is to be planted up with oaks, whether by oak plants, or by layers, these may be put in or brought close to the birch, elder, or any kind of black wood stools, and receive no injury from them, so that the whole ground in the very season after cutting may be filled up, and converted wholly into an oak wood.

SECTION XIV.

OF VALUING STANDING OR GROWING TREES AND WOODS.

HAVING now finished, in as brief a manner as possible, what I intended to say on planting and thinning, pruning, cutting, and training up young plantations and coppice woods, which I hope will, in the meantime, be found sufficient for that part of THE FORESTER'S GUIDE, it will be now necessary that I lay before the forester, to complete his guidance, the manner and method of valuing coppice woods at all ages, as also of measuring and valuing standing or growing trees, of all kinds and sizes; and this being a subject on which none that I have either seen or heard of have either written or said any thing, I must be excused if I should exceed a little the limits at first prescribed to this work, as I must be here somewhat particular. It will be necessary, in the beginning, to give a brief description of the kinds of timber used for most particular purposes, and of course bringing the highest prices; and in this, as in the other part of this work, I shall use only such names for the different kinds of wood as are understood and used throughout Scotland, so that every person, in the least connected with the selling of woods, or working amongst them, may easily understand me.

A plan will be found at the end of this part of the work of my newly invented instrument for measuring standing trees, with an explanation of the manner of using it, whereby any tree, with its branches, can be measured as accurately and expeditiously as if it were lying on the ground, whereby a difficulty of a very serious nature, and of which I myself have often been an eye-witness, is completely removed; that is, I have often seen a shipbuilder apply to a gentleman for a particular tree or trees, say for a keel piece; the gentleman sends him to his forester, and desires him to give him any tree or trees out of this or the other part of his plantations, as will suit his purpose, for which he is to pay a very high price; well, the carpenter knowing he is to pay a very high price, wishes to have the tree or trees he requires as near the sizes as to length and girth as possible, not to have much waste of wood, as he knows he is liable to pay for the whole measurable timber which it contains. In search of this tree or trees, they go through the plantation, backwards and forwards, till perhaps it is near the evening; they now fix upon one or two trees as is required; and two or more men with saws and axes, who, either at the proprietor's or carpenter's expense, have followed them all this time, set to work and cut one down, it is girthed and measured in length; well it is too small at the top; a second is cut down, it is the same. Says the carpenter, "They may well do, if a little too large, but they cannot do too small or too short." He, as I said before, again to save money, and to get them as near the sizes as possible, still cuts, till he has perhaps cut five, six, or eight trees, before he gets one or two to suit his size; therefore, although the proprietor gets 4s. or 5s. per foot for one or two of those particular trees, where is his profit? The carpenter or merchant puts him off with a plausible story, saying, "I will likely require these others next year for a smaller vessel, or soon, and I will give the same price," whereas, they are allowed to lie on the proprietor's hands till a merchant casts up for them; but before this occurs, the trees begin to spoil, and he must now sell them for purposes not so valuable, rather than lose them, perhaps receiving only half-price for them. I have seen cases of this kind more than fifty times; and I have myself often been authorized by gentlemen to give a particular tree or trees, for especial purposes, both in machinery and ship-building, and have been deceived in the manner just described. Now this instrument for measuring standing trees removes all these difficulties, as with it you can take the exact length and girth of any tree, either at the extremity or any part of the body of the tree, with the same exactness as if lying cut on the ground; besides, if the proprietors of woods chose it, they could have all the large or full-grown trees in their plantations, or in any part of them, numbered, and their measurements accurately taken and set down in a book ruled for that purpose; so that a gentleman at London, abroad, or any where at a distance from his estate, carrying with him a book in which are the dimensions and measurement of these trees, should it so happen that at any time he should require a little money over and above his usual income, he can turn up his wood-book, in which he has the number and measurement, and of course the value, of all his trees; he can then pick out such a number of trees, and remit these numbers to his forester or manager, with instructions to sell them, and he at the same time strikes them out of the list, and he knows at once the exact sum, or nearly so, he is to receive for such trees; and besides, should any tree or number of trees be blown down, or broken, or lose their growth, &c. the forester or wood manager writes, sending a list of the number and measurement of the tree or trees thus blown down,

&c.: he at once turns up his wood-book, and sees the tree or trees, and their value. A book of this kind kept by any proprietor of woods must give universal satisfaction. Having in readiness this instrument for measuring standing timber, which is very easily procured, being so very simple and cheap, he will readily take the dimensions of any tree. Admitting his plantations are all young and thriving, and yearly on the increase, they can very easily and expeditiously be measured over as often as need requires; and should a gentleman require to cut only a few trees from his own woods annually, for purposes on his own estate, when he knows the sizes required, he can easily, before cutting, know the very tree or trees that will suit the various purposes required.

A book ruled on the following plan, would be very advantageous, and must be very satisfactory to landed proprietors having extensive woods come or coming to maturity.

Number of TREES *marked off, that should be cut for the Improvement of the Plantations, or that may be cut without injury to the look of the Plantations, with their Measurements and Value.*

Number of Trees.	Descriptions.	On what Farm, or in what Plantation.	No. of		At per foot.	Value of those which may be cut without injuring the look of the Plantations.			Value of those that should be cut for the Improvement of the Plantations.		
			Feet.	*Inch.*		£	*s.*	*d.*	£	*s.*	*d.*

In all wooded estates, it is worthy the proprietor's special attention, and always tends to his advantage, as well as the improvement of his property, and also to his obtaining a perfect knowledge of his increasing annual income, to have his woods, plantations, wood-lands, and timber trees surveyed, valued, and put into the above system by a professional person; and if he, the professional person, be worthy of his trust, he will take special care, candidly, honestly, and without partiality, to state the improvements that should and that could be made with propriety, advantage and profit, with the best, speediest, safest, and cheapest method of executing them simply and plainly, so as to be easily understood by those who are to have the operative management of them.

Valuation of TREES *and* PLANTATIONS *to remain on the Estate, either to be reared up to maturity, or for ornament; also a Report of their State, with observations and Directions for their future improvement.*

No. of Trees.	Descriptions.	On what Farm, or in what Plantation.	Value.		
			£	s.	d.

A most excellent and satisfactory plan for all concerned, when a system of improvement is adopted and agreed on by the proprietor, and put into the hand of the forester or operative manager, particularly when printed, is to bind in a quantity of blank paper at the end of the report of every distinct plantation, in form of a book, on which the proprietor notes down his instructions to the manager or forester, so that he goes on with safety; and if attentive and industrious, with satisfaction to his employers. Also, the manager or forester noting down on his part the expense or time consumed in making all such improvements, when finished, &c.; also the sums of money received for thinning and cuttings, and to what purpose applied, &c.; the proprietor and servants keeping each a distinct book, and comparing them occasionally. When this plan is judiciously attended to, it affords peace of mind and satisfaction to the proprietor, particularly so when the proprietor cannot always reside on the estate, whereby, at whatever distance, he can have a perfect knowledge of what is going on at all times on all parts of his estates. I have oftentimes, particularly on extensive wooded estates, numbered and valued the whole standing timber trees and plantations, according to the approved plan, so that the proprietor knows to a certainty the annual produce or yearly income he can receive for his wood, &c. Such a plan of arrangement will serve the woods and plantations on every estate for twenty-five or more years, and the cuttings of natural oak woods for time immemorial, when once brought to proper annual cuttings, and cannot fail of giving the most universal satisfaction.

SECTION XV.

OF PRINCIPAL PIECES OF TIMBER USED IN SHIP-BUILDING.

THE principal pieces of timber used in all kinds of ship-building, whether large or small, are nearly of the same cast or shape, as they are all built of nearly the same mould; but these differ very materially in point of size; for instance, a small vessel of about 40 tons register, will require a keel nearly 40 feet long, and to square about 8 by 11 inches, whereas a vessel of 80 or 100 tons register, will require a keel about 60 feet long, and to square about 10 by 12 inches, and so on, the other timbers in proportion. It is perfectly sufficient for our purpose here, that I inform the forester of the names of a number of the most particular pieces of timber used in a vessel, and which, when asked for singly, are known to sell highest, and are, on that account, the most valuable.

In order still more to assist the forester in this particular part of his work, I have, in this edition, given engravings descriptive of the curvature requisite for the most principal pieces of timber used in ship-building; which will be seen in the plates; and I have no doubt will be found of the greatest use, both to the proprietor and his forester, in training up and bringing his trees to the highest possible value and usefulness.

First, there is the outer keel: this is commonly used of beech or elm, and made generally of two or three trees or pieces joined together, to whatever length is required: these are looked for to be nearly straight, and sell generally according to the length of the piece, at 3s. 6d. 4s. and 4s. 6d. and some years ago as high as 5s. per solid or cubic foot.* Second, the keel-stone, or inner keel: this requires trees of nearly the same description, but are chiefly made of oak: these I have often sold as high as 7s. and 7s. 6d. per foot, during the late war.† Third, floor timbers: these are sometimes used of elm and beech, are a little crooked, and generally sell at 2s. 6d. per foot. Fourth, first crooks: these are a good deal crooked towards the one end, as they begin to ascend up the vessel, and are more valuable than the floor timbers; but are also used sometimes of elm and beech, and generally sell, when asked for singly, at about 3s. 6d. per cubic foot. Fifth, upright timbers: these are always made of oak, and are considerably crooked, and these sell, when asked for singly, at 3s. 9d. per foot. Let it be here observed, that elm or beech is seldom put into a good vessel, except the lower part, called the floors, where the vessel is always under water when light. Sixth, top timbers: these are also of oak, but not so valuable, as they are mostly straight, and although asked for singly, only bring about 3s. per foot; keeping in view that the feet used here are solid or cubic feet, line measure, 1-4th of the girth taken for the side of the square. Seventh, beams: these go under the deck of the vessel, and are also oak, and have but a small curve, but require trees of considerable length, and are valuable, say 3s. 6d. and sometimes 4s. per foot. Eighth, knees: these are always of oak, and are the most principal crooks in the vessel; and when these are asked for singly, they generally bring about 5s. or 6s. per foot, according to their sizes. I have known ship-builders, in repairing vessels during the time of war, charge 10s. 6d. per foot for knees, and within these two years, charge 7s. 6d. per foot for such. Ninth, stem-piece: this a very particular crook, and when asked for singly generally sells at 4s. 6d. and 5s. 6d. per foot. Tenth, breast-hooks;

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* It may be proper here to inform my readers, that when the cubic or solid foot is mentioned, it is always to be understood line measure, and one fourth of the whole girth taken for the side of the square.

† Let it be understood, that since the peace, there has so much of beech, elm, black birch, and oak, come in from America, which is applied to the same purposes, that it has greatly reduced the prices of this kind of timber, although it is allowed on all hands, that the American timber is not near so good. Still, it has brought the prices of our timber of that description down 1s. per foot from what it was formerly. But now, in 1824, the deficiency of durability of the American timber to our Scotch or English timber is seen, and our timber is now in demand, and rising in price; and often ship-owners, in contracting for ships, prohibit the using of American timber in any part of the ship. American timber has been known not to last above six or seven years in ships, when used as timbers, and in planks a much shorter time. The American timber is still excluded, 1827, in the building of good first rate merchant vessels, but still there are great quantities of it in use in ships built on sale and in other purposes.

these also have particular crooks, and sell at 4s. 4s. 6d. and 5s. 6d. per foot. Eleventh, stern-posts and windlass, are straight pieces, but when asked for singly, sell at 4s. per foot. Twelfth, trees that will cut up for planking: these are used of as great a length as they can be got, and are the better for having a considerable crook or curve one way: these are used of elm or beech* for planking under water, and sell from 3s. to 3s. 6d. per foot; but four planks of oak are required for one of beech or elm for this purpose, and if oak, they commonly sell at 4s. and 4s. 6d. per foot. (See a figure of each of the different crooks in the plate.)

These are the principal pieces of wood used in ship-building, that are of the most value, when asked for singly,—but prices will vary a little, as circumstances or the demand occurs. But when a large promiscuous lot of oak, or any other timber, say large and small, crooked and straight together, is sold to a ship-builder, he generally pays what is called an average price for the whole, say from 2s. 9d. up to 3s. 6d. per foot. It is worthy of observation here, that the most valuable, and by far the greater part of timber used in ship-building, is crooked: it is therefore greatly for the interest of the proprietor that the forester attend to make his trees grow as crooked as possible, particularly in a forest for profit: for this purpose he may consult Section III. This ought, and I hope is, particularly attended to, in the national forests, and on all proprietors' estates, holding a local situation to the sea. Numerous and various have been the schemes resorted to by authors and even tradesmen to crook timber. I know of none that will succeed with the forester in rearing crooks in the forest, but that I have already laid down for his guidance, and which twenty years experience has proven to a demonstration, to be the most effectual yet found out, as every year during that period has it been put in practice in many instances, and few or none have ever misgiven when properly attended to; and it must be confessed and allowed at all hands, that there is neither the strength nor durability in artificial crooked logs of timber, by whatever means it may have been effected, that there is in natural grown crooks. Mr. Pontey, in his Forest Pruner, clearly manifests his ignorance of working timber crooks as a tradesman, when he asserts the following: "Notwithstanding," says he, "the stir most authors who write upon timber, make about growing bends for ship-building timber, we believe little is hazarded by saying, that if plenty of long, clean, straight, free grown trees could be got, there would be no want of for crooked purposes. For as to knee timber, much of it must be produced under any system of management, and as to ribs and every other article requiring a moderate curve, they certainly may be made not only stronger, but every way better from straight wood than crooked." This every mechanic knows to be a most glaring and gross absurdity, and, provided that sort of wood was not so very scarce, they would also be made much cheaper in two respects; the first is matter of labour; they might usually be sawn at once so as to require very little hewing, and certainly under such a process much weight of wood might likewise be saved. The refuse of a ship carpenter's yard shows the immense waste occasioned by cutting irregular bends to the desired curves. Boiling, and a screw apparatus to form the bends, would at once make the straight crooked just in the way required, while the strength of the wood would be retained instead of being cut across, as must be the case, less or more, under the present practice. Indeed, this method would frequently occasion two other savings; as such from their strength might often be made lighter than the others, this would reduce the expense of carriage. We have tried oak, ash, and larch, and find that with but little boiling they easily bend to any given curve, and fix in it as they cool." So says Mr. Pontey. It is a well known fact, that in all ship-building, the planks which are generally from two inches to six inches in thickness, and from six to fifteen inches in breadth, and these are bended by steam or boiling, and when hot are bent and screwed, and strongly fixed to the timbers or place they are to occupy; but even in binding, however small in proportion these are to the timber of a ship, yet they often spring in the reed or chamf of the wood, and particularly so, if there is the least tendency to cross-grained, or knotty timber. And I may here notice by the way, that a stroke on the bends or bows of a ship has often sprung the end of a plank, which naturally coming back to its old position, has been the means of bringing many a gallant ship to the bottom of the sea. Nor is crooks hewn out of straight timber so strong by the one-half as natural grown crooks are; besides there is, as Mr. Pontey justly says, an immense waste of timber, which a carpenter's yard shows, by hewing straight timber crooked. As to the boiling system to crook the large heavy timbers of a ship, it is so absurd of itself that it carries in it its own confutation; and a ship of any considerable size built by such a method, would no sooner be launched off the stocks into her natural element, than, to use a phrase of sailor Jack's own, " her sides would be looking all the arts of the compass." Take, for example, a floor timber of an ordinary-sized ship, which must square to from twelve to eighteen inches in thickness, and from twelve to eighteen feet long; boil it for a day, or days if you will, which, by the way, is a labourer's job; bend it by screws to the position or curve wanted; keep it in this position for ten days or more till perfectly cool, then place it in its place on the keel of the ship; the place it occupies requires the two ends of it bent upwards to the sides of the ship, on the ends of which is placed the other timbers or ribs of the ship, all which the upward bend of the floor timber has to carry and support, as also it is the principal support of the cargo of the ship when loaded, which it would be impossible it would sustain without giving way, less or more, to its old straight position. Besides, as some of these timbers thus artificially bended would stand the bend more true and keep it longer than others, I am bold to aver, that long before the ship was finished building, there would not two of these timbers thus artificially bended keep the same bend they were intended to have till the ship was finished building, so that it would be impossible to keep a ship to any given or proper shape. For example, when an operative mechanic, in making a wheel for a mill once, I had recourse, with the consent of the owner, for want of proper crooks, to bending by steam, as in that of ship planks, the timbers for the sole of the wheel; the wheel was finished, and a very good looking job it made. The wheel had not gone round for ten days, when, like Jack's ship, it was turned all the arts of the compass, and would not so much as go round within the boundaries of the ark; and all we could do with screws, and cramps, and iron bolts, could not keep it right, and recourse was had to a new wheel on the old system of natural grown crooks, and so would it fare with ships. It will always be of the greatest consequence to have crooked grown timber for ships.

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* There is scarcely any elm or beech used in what is termed first rate ships, these are wholly of oak; but still, in ordinary good merchant ships vast quantities of elm and beech are used for the above purposes, but always under water where the vessel floats when empty.

SECTION XVI.

PRINCIPAL TREES MADE USE OF IN MACHINERY.

Since the making of cast and malleable iron came to such a degree of perfection in Britain, it has greatly reduced the quantity of timber demanded for mechanical purposes. The prices of cast and malleable iron have been so low that it is now applied to many purposes in which timber was formerly used: besides, a great many of the large gun carriages, both on board of ships of war and also in land service, were formerly made of the best of oak, elm, and ash, but are now chiefly made of cast and malleable iron.

The principal kinds of timber in use for mechanical purposes are oak, elm, ash, and planetree.* Oak is used for mill-wheel axletrees, and, when required for this purpose, must be of a large size, and of good quality; and a tree for this purpose usually sells as high as from 5s. to 7s. per foot. The arms too of a mill-wheel are sometimes used of oak, elm, or ash, which sells at 4s. and 5s. per foot. The ring of the wheel is sometimes of ash, planetree, or saugh, and when crooked to answer this purpose, generally sells at 3s. and 4s. per foot. The buckets of the wheel are either made of saugh, (which is the best) or of fir. When saugh is asked for this purpose, it generally sells from 2s. 6d. to 3s. 6d. per foot. Whatever inside machinery about a mill is made of wood, it is most commonly of oak, elm, ash, plane, or sometimes beech, and when asked for those purposes, generally sells at from 3s. to 4s. per foot, according to the largeness of the sizes that are required. Large planetree is often asked for, which is used both in printing and bleaching works, called beetling beams, a kind of tree that was very difficult to be obtained, and often sold at a very high rate. It is necessary this should be a tree that would work to from 18 to 24 inches diameter, and from 12 to 18 feet long, perfectly clean and straight. Trees of this description when asked for singly, always did and will sell at a very high price; for I have often seen paid for them, when bought singly, from 7s. to 8s. per foot. Large planetree is used also for mangle or calender soles. When bought for that purpose, it brings from 3s. 6d. to 4s. 6d. per foot. Planetree is used also about cast iron foundries for making patterns, &c. which sells at from 3s. to 4s. per foot for that purpose. These are the most of the particular kinds of hard wood made use of for machinery, and when asked for singly bring the highest prices.

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* Notwithstanding the excellent quality of the Spanish chesnut timber, which is equal to the oak in ship-building, and also for any machinery, yet it has not been generally used; but this tree should be both more planted and more used as timber.

SECTION XVII.

PRINCIPAL KINDS OF WOOD MADE USE OF IN CARRIAGES, HUSBANDRY UTENSILS, &c.

UNDER this head we may class waggons, coaches, and carriages of every description, as the same kinds of timber are used in the whole of them.

The principal description of timber used for carriage wheels of every kind, is elm for naves; oak for spokes; ash, elm (and some use beech) for fillies. Elm, when required for coach or carriage wheel naves alone, sells from 3s. 6d. to 4s. 6d. per foot. Spokes are what is generally termed blocked before they are sold, and they are generally blocked out of small oak trees, for which purpose the oak timber of natural coppice wood is remarkably well adapted; and these are used at various lengths and sizes, according to the height and strength of the wheels. Chaise wheel spokes, long and short, taken together, sell at 40s. per long hundred, say 120 to the hundred, or 8s. 6d. per gang, of 26 spokes to a gang. Spokes for common-sized cart wheels sell nearly at the same price, and in the same way: ash and elm for fillies, at 3s. and 3s. 6d. per foot, and beech at 2s. 6d. per foot. The principal part of timber that is used in coach-making, and when it is found to answer for poles, perches, or splinter bars, &c. and purchased singly for that purpose, sells at from 4s. to 4s. 6d. per foot.

Ash is chiefly used for plough beams, and cart trams or shafts, and it commonly sells, when asked for that purpose, at about 4s. per foot.

The common carters and carriers in Edinburgh, Leith, Glasgow, Greenock, &c. prefer using for their cart sides or trams young oak trees, such as one whole tree to work into a side or tram; and when these are got good and suitable for their purpose, a very high price is paid for them, from 4s. 6d. to 6s. per foot. Larch fir is often used for this purpose, and is found to answer well.

Ash and elm are used for harrow bills; but when large birch wood can be got, capable of being cut into planks for that purpose, it is used in preference, and makes excellent harrows, much better than either ash or elm, as it is of a more tough nature, and not so subject to split either with the drought, or in driving the iron teeth into it, particularly when it is used with the heart in it.

SECTION XVIII.

THE PRINCIPAL KINDS OF WOOD USED BY COOPERS.

SINCE the British Parliament authorised herrings to be put into barrels made from British timber, and gave the same bounty for herrings cured in these barrels, and allowed them to be exported, which formerly was not allowed unless the barrels were made of foreign oak, ever since that time large quantities of elder, birch, and small hard wood of all kinds, have been cut for that purpose; and since circular saws have become so plentiful throughout this country, which is a most excellent and expeditious method of sawing up small woods, and particularly into herring barrel staves, the prices of small woods for that purpose have become somewhat considerable; hence it is that plantations, many of which are to be met with in the Highlands of Scotland, consisting almost entirely of birch and elder, and which, in former times, were considered of little or no value, and were chiefly cut for fire-wood, have of late been sold for considerable sums of money; and as circular saws require very little machinery to erect and set them agoing, and when a place can be found for them near a plantation of this kind, it of course enhances the value of the wood very much, because after it is cut up into staves, &c. it becomes very portable, and easily carried to sea-ports, although the plantation should be a considerable way inland, and the broke or brushwood that comes from the saws can be sold to good advantage in an inland country where coal is so scarce and valuable. These circular saws cut up immense quantities. One saw driven by a four horse power, (either by water or otherwise,) when wrought and attended to by two or three men, will cut up one thousand barrel staves each day.* But observe here, that the 1000 barrel staves are 1200, it being the customary way of selling them by the long hundred. Some will be ready to say that these saws, cutting up such large quantities in one day, when there are now such numbers of. them at work in the country, will speedily overstock the market; but let it be here remarked, that the quantities consumed annually are immense. I have it from good authority, that at the port of Leith alone there are used annually of herring barrel staves upwards of *ten hundred thousand;* in Greenock, Port-Glasgow, and Glasgow, as many; the like number about the Western Highland Lochs; Burntisland, Dunbar, and the coast of Fife, including Dundee, an equal number; and in the northern counties, say from Aberdeen to Wick, a great deal more than one million: so that there are no fewer than five millions of staves used annually, which must take an immense quantity of wood; but no small portion

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* See these saws brought to a very great degree of perfection on the estate of Closeburn, the property of C. G. Stewart Menteath, Esq. Dumfries-shire, where large timber as well as small is cut up with these saws, and to suit all purposes. A. H. Belshes, Esq. of Invermay, Perthshire, has saws of this kind, and many others, who found them extremely useful for many purposes on their estates. I would recommend it to every gentleman who has any quantity of wood, to have one of these saws, as the expense of erecting them is so very trifling, and the advantages of them so very great. Home Drummond, Esq. of Blairdrummond, M.P. erected one very lately, which he found to be of great service to his estate in many respects. On all estates, where wood is the principal object, these saws are of great use, and save a great deal of manual labour. These saws have also become common,

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and are found extremely useful, on a very small scale, driven by two men, assisted by a fly-wheel, and made so very portable, as to be easily removed from one part of the woods to another, in cutting up fire wood, and makes it to be easily removed from dens and places where otherwise it would lie to rot, and is a very cheap method of converting into fuel what would otherwise be lost, and is of course a very great saving about any gentleman's house where coal is scarce and dear. Many have found great advantage from these saws since I published the second edition of the Forester's Guide, and many more, I trust, will still reap these advantages.

of this is made from American hard wood, both at Leith, Greenock, and Glasgow. As this is an article that is likely to continue in demand, and as birch and elder wood will grow and thrive in marshes, when no other kind of wood will, such gentlemen as have a quantity of land of this description, that cannot be drained to grow oak, would do well to plant it with wood of the above description; and as it grows very rapidly from the newly cut stock, and does not require much care or attention, though to do it justice it should have a little in the same way as the natural oaks, it will be perfectly ready and fit to be cut for stave wood every fifteen, or from that to twenty years, provided always those stools be thinned in like manner with oak. A piece of ground which is hardly fit for any other purpose, may in this way be turned to very good account. There is no danger of the want of demand for staves, while government continues to give the bounty for herrings put into barrels made from British timber. The consumer of staves generally requires that they should average four inches broad, but they are used from two to six inches broad, and thirty-one inches long, and to stand in the barrel when finished half an inch thick. Staves of the above description, (say in general averaging four inches broad,) sell at the port of Leith, &c. or where they are used, at about

L.6 Sterling per thousand. Sixty square or cubic feet of timber will cut into one thousand staves. Wood bought for the purpose of cutting into staves, if near a seaport, where it can be readily carried to a market, sells at a 1s. per foot, the purchaser being at the expense of cutting, carriage, &c.

Small planetree is also used by coopers for herring barrel ends, and is very easily cut up for that purpose with the circular saw. When cut for this purpose there is no matter what the length or breadth be, but the thickness must be five-eighths of an inch after being finished in the barrel; and when cut up, and sent to market with the staves, sell at two-pence and two-pence halfpenny per superficial foot, or nine-pence for as much as will make a pair of ends, each to work eighteen inches diameter. When small planetree is bought in the woods for this purpose, and when near water-carriage, it sells from 1s. 6d. to 2s. per foot.

As this is a new source of consumption for timber of the above description, I have been the more particular regarding this part of the subject; and I have only to add here, that if our American supplies were shut up, how soon would our home supply be exhausted of this single article, however insignificant it may appear as a species of timber? I do not mean to be understood here as saying, that this kind of timber should be planted in preference to the oak, or other more valuable kinds; but it will grow, and can be reared in land, where no other kinds can, and in all such lands I would recommend it to be planted. To a tenant of a farm entering on a nineteen years lease of his farm, I would strongly recommend planting all places of his farm of this description with this kind of timber. He can plant and rear it up for a trifle, and if taken anything like care of, at the end of his lease it will pay him at least L.50 an acre, upwards of L.2, 10s. per acre of annual rent for land he could not otherwise bring two shillings an acre for; and besides, he improves his farm for the proprietor, by having at the end of his lease a fixture of natural stools left him on land before worth nothing, so that both the landlord and the tenant will be benefited by such an improvement, and is worthy attention.

SECTION XIX.

THE CONSUMPTION AND USE OF WILLOW OR OSIER BY COOPERS.

Of osier, or hoop willows, there are a great many kinds, no less than eighteen; but it is sufficient for my purpose here, that I mentioned those kinds only that come soonest to maturity, and are fit for making good barrel hoops. For this purpose I need only notice two kinds; first, the common osier, or hoop willow, and secondly, the Huntingdon willow. Both of these two kinds grow excellent hoops; and, if properly managed, are ready to cut alternately for that purpose every three years. Having mentioned in the preceding section the immense quantity of staves made use of in herring barrels alone, it will very readily occur to every person, that the quantity of hoops used for making up such a number of staves into barrels must be immense, as every barrel takes at least twenty hoops. I have been informed by many of the most respectable of the consumers of this article, both on the east and west coasts, that barrel hoops are for the most part imported from Holland and England, whilst they admit that Scotch hoops are equally as good when they can be got. I have also been informed by some of those gentlemen who have themselves cut some plots of Scotch hoops, that although there were 5000 acres of land in Scotland, all bearing good hoop willow, and these cut alternately every three years, it would not be more than sufficient to supply the annual demand of this country. These hoops, after being split in two, sell in bundles of 120 in each, at from 4s. to 5s. per bundle. This is on an average 4s. 6d. for every 60 round hoops.—What a large quantity of these even a single acre would produce! I am informed, there are many acres of hoop willow ground in England that pay an annual rent of L.10 per acre. Some authors go the length of L.30 per acre. I know several pieces of ground in Scotland growing hoop willows, that pay annually a rent of L.9 per acre; and there is a small barn-yard in Stirlingshire, where there are about 100 stools of hoop willows growing from the side of a useless ditch, which have brought in regularly during the lease from L.4 to L.5 every three years. Sure I am there are many gentlemen in Scotland who have many acres of marshy places, capable of carrying hoop willows, for which I believe they draw little or nothing. These keep a gardener or forester, and they might, with very little trouble, turn a few acres, or even half an acre less or more to very good account in this way, as it requires very little management after being once planted. A few years ago, Hugh Baird, Esq. engineer, proposed to the proprietors of the Forth and Clyde canal navigation, to have some parts of the canal banks planted with hoop willows, which went on prosperously for some years by the direction of that indefatigable gentleman, particularly that part of the canal bank called the Bog, which is well adapted for that purpose; and had it been properly managed, would have been a considerable source of revenue, besides beautifying the banks, which I am sorry to see now in a state of total neglect. The late Right Hon. Lord Viscount Keith had a great number of acres of wet land on his estate of Tulliallan, which, if he had been spared, he intended to convert it into willow land. I hope his Lordship's successors will find it their interest to do so. Tenants of farms would do well to attend to this when they have land for the purpose, as no kind of crop will pay them better.* To encourage them to it, I insert the opinions of the ancients on this subject.

Of the Culture of Willows, from some very Ancient Authors.

WHEREVER there are vineyards, there is a great demand for willows. They were used by the ancients for binding the vines to the trees that supported them, and for making all sorts of baskets used in the vineyard. Cato, after directing in what manner to plant reeds, adds, " Plant the Greek willow around the reed field, that so there may be twigs for tying the vines." Varro expresses himself to the same purpose. A jugerum of willows was reckoned sufficient for twenty-five jugera of vines; but willows were necessary, not only in the vineyards, but also in the olive yards. This Cato directs that willows be gathered in time to make baskets for the olives. A crop of willows was reckoned so valuable in the time of Cato, that he ranks the willow field next in value to the vineyard and garden. With respect to the culture of the willow, he says only that it should be planted in low marshy and shadowy places, near to rivers.

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* Need I tell my readers, that since I published the first and second editions of the Forester's Guide, I have had occasion to be in Ireland, and in many counties of it; and not so much as in one solitary instance did I ever hear of any hoop willows being raised to any extent, and yet there is hundreds of acres of fine marshy land fit for that purpose and nothing else, which little or no expense would bring to pay at least a regular return of L 25 per acre every three years. I hope my Irish readers, proprietors, and tenants, will profit by the hint.

Columella and Pliny treat more particularly of this subject. " The most proper land for the willow," says Columella, " is that which may be watered, or is naturally wet; however, rich land lying flat answers very well." These ancients reckon three principal kinds, which they denominate the Greek, the Gallic, and the Sabine. " Of these," say they, " either tops or cuttings are planted: cuttings one and a half foot long are planted, pushed down as far as the solid earth, and covered over a little." " The time of planting is before the buds come out; the branches to be used should be taken from the trees when dry, for if they are cut when wet with dew, they do not succeed well; for the same reason, neither are they to be lopped on rainy days. Unless great care is taken, many of the willows die when newly planted. In the room of these that die, others ought to be propagated by layers from the nearest plants: these are made by bending the tops of the branches, and fixing them in the ground; in this manner the places of those that die are supplied. The layer, when a year old, may be cut from the stock, as then, like a vine treated in the same manner, it may be nourished by its own roots." So far does Columella go even in the nature of layering, which seems to have been practised amongst the ancients.

The same author, after treating of the culture of broom, which was used for the same purposes with the twigs of willows, adds, "The willow for poles requires much the same kind of soil with the willow for twigs; the best kind, " says he, " is a field that may be watered; it is planted by branches, and when it buds, is trained up to a pole." Pliny, treating of the subject, expresses himself in this manner: "Of the things planted for the benefit of the vines, the willow holds the first place; it is planted in moist land, digged two and a half feet deep, by twigs or rods, one and a half foot long, the larger the more useful. The intervals between the rows should be six feet wide; when three years old they should be cut within two feet of the ground, that so they may spread to the breadth, and be cut down without ladders; for the willow is the more fruitful the nearer it grows to the earth. It is necessary that these be digged about every year, in the month of April. This is the culture of willows when designed for twigs. When they are intended for poles, let twigs or rods be planted upon land prepared in the same manner, and poles may be cut from them in the fourth year. Such as die may be replaced by layers from the old stocks, a branch being put into the ground, and after a year cut from the old root."

Here are two clear proofs of layering, and that too recommended by these two ancient authors. It appears that they were in the practice of layering from the branches of trees; and if it succeeds from a branch of a tree, of which I have seen many undeniable proofs, it is much more rational and natural to suppose that it will succeed much better from the main leading shoots of the roots. None need be the least afraid of putting this plan into practice, for they will be sure to succeed, and that too beyond their expectation, with the kinds advised in the section on planting.

Let us hear what Mr. Dickson, in his excellent book on Husbandry, says on the cultivation of willows. "There is not," says this author, only taking the use of willows for vineyards, "so great a demand for willows in Britain as in Italy, and other places, where there are vineyards; however, the demand for them is greater than can be at present supplied; at least it is so in many parts of the kingdom. We have many low, wet, and marshy lands, very fit for raising them, and which, in their present situation, are of very little or no value. These may be very properly applied to this purpose. Such of our farmers as attempt to raise them, are far from being so careful in the culture of them as the ancient Roman farmers were. This possibly may be the reason that there are not such profits from the crop as to encourage them to proceed. But were they to imitate the Roman farmers—prepare the land for being planted, by trenching it two and a half feet deep; carefully dig around the plants after they are set, and keep them free from all kinds of weeds, they would have good reason to expect a very good, and if in a convenient part of the country, a very valuable crop." I have often been much surprised, that many farmers, whose farms to my knowledge contain from one to ten acres of land fit for this purpose, do not plant and attend to them in the foresaid manner, as it would pay one year's rent of their whole farms every three years, and that from land which, in its present state, does not pay them 5s. per acre. This is sluggishness with a witness!

SECTION XX.

THE PRINCIPAL KINDS OF HARD WOOD MADE USE OF BY CABINET-MAKERS.

THE principal kind of hard wood made use of by cabinet-makers is mahogany; but they sometimes make use of elm for chairs, beech for bedstead framing, planetree for common tables, and Spanish chesnut for boxing, drawers, &c. in the room of wainscot, holly, and sometimes limetree for inlaying. Elm, for chairs, generally sells at 3s. per foot; beech, for bedsteads, at 2s. 6d.; planetree, if large, for tables, at 3s. and 3s. 6d. per foot; Spanish chesnut, for boxing, at 2s. 6d. per foot; though Spanish chesnut is of much more value when suitable for ship-building, as it is often used for that purpose; holly, for inlaying, 2s. 6d. per foot. Planetree is also used by block-makers, and sells, for their purposes, at 2s. 9d. The carvers and gilders use chiefly limetree, for picture and glass frames, and generally buy it for this purpose at 2s.

6d. per foot. Turners use chiefly beech, birch, planetree, box, holly, &c.—Beech, for their purposes, sells at 2s.; birch, at 2s. 6d.; planetree, 2s. 6d.; and box and holly, at 4s. per foot. Locksmiths use chiefly beech and planetree, of which they use great quantities for lock stocks, which they buy at 2s. 6d. per foot. Last-makers use always beech for lasts, and buy it at 2s. They were accustomed to use birch for heels and patten stocks, when they were required, and bought it for that purpose at 2s. per foot. Large quantities of American black birch, and other kinds of American hard wood, has been adopted by cabinet-makers and other tradesmen, for many of the purposes mentioned, which has both lessened the value and demand for the hard wood of this country.

It will be interesting to my readers, and particularly so to all planters and foresters, before entering upon the valuation part of our work, which must always hold a very distinguished place with every proprietor, planter, and forester, to give them a brief description of the various forest trees that are of most value, and of course the most profitable for rearing, and that, at all times and all places of the country, meet with a ready sale, which, of course, renders them most worthy of his care and attention wherever profit is the sole and only object in planting and rearing. I shall also give as brief a description as possible of their nativity, soil, purposes, and value; and in doing this I shall strictly confine myself to those forest trees only that are at all times in general demand in the three kingdoms, and, of course, the only ones to be propagated solely for profit. Let us begin then as above with

THE ASH.—*Its Nativity, Soil, Situation, Purposes, Value, and Seasoning.*

The ash is allowed at all hands to be originally a native of Scotland and Ireland; but, like the oak, it may be said to be a universal tree, as it is to be found in almost every nation and clime; but its particular qualities as a useful durable timber tree is best known in Scotland and Ireland. Of this after.

Soil and Situation.—The natural and favourite soil of the ash is a light rich moist mould; but it will grow almost any where: we find it in very sandy, rocky, stoney, and barren soils. I have seen it thrive well in marshes and half-drained bogs, and close by the sides of rivers where almost any other tree will hardly grow; and it may with safety be planted in a much wetter soil than almost any other tree. It will also grow on sides and tops of rocky, barren, bare, and bleak hills, and in exposed situations; but in such places it does not arrive to that magnitude as a timber tree that it will do in a plantation, or a more sheltered situation. In all bleak and exposed situations, where it is necessary to rear the ash, it should always be cut over and reared as a coppice tree from the natural stool, as the natural shoots of the ash make great progress, and in this way can be speedily reared up as a timber tree, which is elsewhere taken notice of in this work. The ash grows to one of the loftiest of our forest trees, provided it is planted in its native soil in a plantation or grove, where it will generally lengthen out to a beautiful clean stem or trunk, and rises to an astonishing height; and situations of this kind is the most proper for rearing the ash for profit, as its value chiefly depends on its length and cleanness of timber. The ash, too, will grow to a very great magnitude, as a single tree, when the soil and situation suits, and will form an evenly and beautiful top, but generally throws out large arms and a short trunk; but the trunk grows and swells out proportionably large.

As value and profit is our chief object, we have little to do with ornament; we may here notice by the way, that although the ash is amongst the most valuable of timber trees, yet it is amongst the last trees which foliate in spring, and amongst the first which fall off in autumn; and this alone depreciates its value very much as an ornamental tree, especially in pleasure grounds. The ash is also an unwelcome tree to the gardener and farmer, if either near a garden or corn-field; it spreads its roots and tops to a great distance round the stem, and, as we said before, requires a good deal of nourishment, which impoverishes every thing near it; and the droppings from off its branches being destructive to all within its reach, it should not be planted where it will do mischief.

Its Purposes and Value.—To enumerate all the different uses and purposes of the ash, would require a volume by itself. In this point of view it is undoubtedly next to the oak: it is useful to the farmer for every purpose of husbandry; and it would be difficult for him to carry on his business without it. It is also the most useful timber for the coachmaker, as all the principal parts of a coach are of ash. It is also the principal timber with the mill-wright, machine-maker, wheel-maker, and also about cast iron foundries. Coopers and even housewrights have often used it for roofing and joisting in houses, and to descend so low, there is no wood equal nor indeed so suitable as the ash for all kinds of handles for working tools of every description, as spades, picks, axes, &c. and also for riddles, sieves, baskets, and poles of all kinds. It would be in vain to enumerate all the purposes that the ash timber is useful for. For all these purposes, it will be necessary to remark, that the more tall and clean the stem of the ash tree can be reared to, the more valuable will its timber be. In this case, to rear the ash for profit it should be always planted and reared up in a wood plantation or grove, either by itself or amongst other trees; and in such places where the soil is suitable, the ash will grow very rapidly, and may be said to arrive at maturity, that is, to be useful and valuable timber, at the age of from forty to sixty years, although it will live to a considerable age, and grow to a great magnitude, but when it grows to a great age, the timber of it becomes more free. The timber of the ash may be said to be at its best for toughness and durability about the age of sixty, if it has got room in the plantation, &c.

Varieties.—There is said to be a great many various kinds besides the common ash, such as the silver-striped, the gold-striped yellow-coloured ash, flowering-ash, dwarf-ash, manna-ash, white-ash, black-ash, and the new discovered ash, but with these the forester and I have nothing to do: it is sufficient for our purpose to notice the profitable kinds for rearing, which is the common ash, and such as is seen in almost every wood and plantation. It is, however, worthy of remark here, that the ash in Scotland and Ireland is far superior in quality of timber to the English or foreign ash. The Scotch and Irish ash will answer every purpose that ash wood as timber can be applied to, whereas the English ash, for the greater part, is soft and free, similar to the American, and other foreign ash, and only fit (especially when it is old) for pannelling, boxing to drawers, for cabinet-makers, and such like. This, say some, is owing to the soil and climate; this, however, I cannot agree with, as on many estates in Scotland, and even in England (although for the most part the ash, in all places of England, is soft) you will get trees of both kinds, and that standing in the same field or plantation; for instance, on the estate of Alva, on the hill behind the mansion-house, (on the face of the Ochil hills,) there are numbers of ash of both kinds growing within twelve and fifteen feet of each other, but the greater part of the trees on this estate is of the latter kind, ten trees to one are of a most excellent quality. Upon this hill of Alva, in the aforesaid wood, I have found numerous seedlings of both kinds; and some of these from the seeds of both kinds arrived at trees, hence I conclude that it is in the keys, as they are termed, say the seed, chiefly that makes the difference. Although in a rich soil, where the trees grow exceedingly fast, it has a tendency to grow soft timber, but on the soil as aforesaid, it is far from being too rich, as it is on bare whin rock where in many places there is scarcely any soil perceivable. I would, by the way, advise the English planters to get their keys or seed from Scotch or Irish ash. When it may be necessary to rear the ash as coppice, it should be allowed to stand two cuttings of the oak, to make its timber valuable, as it produces no bark of value, but in almost all places where ash will grow as coppice, so will oak, and oak should always have a preference as the most profitable. The prices of the best ash timber at a shipping place in Scotland, Ireland, and some counties in England, when the timber will square from eight inches and upwards, is from 2s. 6d. to 3s. 6d. per solid foot of line measure, as the lengths of the pieces may be suitable for good purposes, so will the price arise. An average good cargo will be 3s. per foot, and an average cargo of the soft inferior ash 2s. per foot. (See the prices more fully in another part of this work.) A Scotch acre of ash trees nursed up to forty years old, will, in an ordinary soil, produce upwards of 4000 feet of timber, worth above L.600 sterling; the thinnings will have paid the expense. Thus the ash is a tree well worth the planter's notice, and should be propagated with care. I must say, as has been elsewhere observed, that the prices will vary a little as to place and circumstances.

Felling the Ash.—The best time for felling the ash is the depth of winter, when the sap is altogether at root; when the sap is ascending or descending, it becomes subject to worm-eating or rotting, and loses a great part of its toughness and strength, and of course less durable. The ash should always be felled from after the 15th of November till the last week in January, and never before nor after that time, to have good timber, and to do it justice; nor is it at all easy to season ash timber properly when cut down at any other season than the above.

Seasoning the Ash.—It is a well authenticated fact by tradesmen, that to make a piece of work of whatever kind (but particularly when strength is required) of unseasoned wood, it gives poor satisfaction, and a tradesman is often blamed for bad workmanship when the fact is, the blame is in the timber: when a tradesman goes to a timber yard and buys a little timber, he may often be deceived as to its being seasoned or cut at a proper time; therefore, although the wood may look well, if it wants these two requisite particularities, it will make but a bad job; if possible, a tradesman, for his own credit, should keep a stock of well-seasoned timber by him. The only and most effectual method I have yet been able to discover for seasoning the ash, and to retain all its toughness and strength of timber, is to cut it down at or within the time mentioned, strip it of its bark,* put it in a shade, on spars to keep it off the ground, where the sun will not reach it, but open at both ends, where the wind will blow through it freely; turn it frequently, and keep it in this state for at least nine months, then saw it up into the purposes it is designed for, put the planks up on end in what is called a wood rie, in an exposed situation, and allow the weather to beat on it for other six months, turning the planks up end down, and outsides in frequently; at the end of six months, let them be properly dried, and put them into an open shade, filled up with spars betwixt each plank, to allow the wind to pass and repass through them carefully, keeping them from wet; allow them to lie in this state for other three or more months, when they may be worked into any purpose with safety, and all the strong, tough, hardy property of the wood preserved. This, or to bark the tree early in spring, say in the month of April, without cutting it down, and allow it to stand barked for fifteen months before cutting it, when it may be sawn up immediately, and dealt with as above; another plan is, to cut it up immediately after being cut down into the purposes

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[*] All trees cut with the bark on, should be immediately stripped of their bark so soon as cut down, as the bark being allowed to rot on the tree always genders vermin, and often worms the whole log of timber, and always does so to a certain depth; this is particularly the case with the ash when allowed to lie in the log till the bark rots off.

wanted, and put it into a stove, the same as the dry rot stove, and dry it by fire till every particle of the natural sap is extracted, this is the way to bring it readiest to use, and for many purposes will make it most durable; and, indeed, when the ash or any other kind of timber is to be used for mill-posts, gate-posts, or in any piece of workmanship where it is not liable to any sudden jerk, this is by far the best method of seasoning it, and it will make it last for generations without decay or rot, even when exposed to wet and dry, or above and under ground. I have tried boiling, steeping in water, burning in the earth and in the dung-hill, and various other means, as is recommended by many; but in boiling and steeping, the wood is always liable to twist and warp, and burying it shortens the grain of the timber, and destroys its durability. I have been the more particular here on seasoning, as in other cases a reference to this may suffice. Before dismissing the ash, although I have pledged my word at this time not to interfere with the nursery, I beg to observe, that the ash may be propagated from a bough, slit off with some of the old wood a little before where the bud swells.

Properties of its Foliage.—No wood is so sweet in the bud as the ash, and for that reason there is none on which cattle so much love to browse; it requires to be defended from them in young plantations with great care; but it may be made useful in a proper manner for this purpose. The cuttings, or small twigs, will feed deer in hard winters. There is a sweet and sugary juice with which the tops of the ash abounds, which is very pleasant to the taste; this makes the cattle very fond of it. It is also said to fatten swine. This sweetness makes it very inflammable; and it is excellent fire wood even when green.

Poison-Ash.—The story of Professor Kalm of the poison-ash may be more curious than instructive. This tree, says he, grows naturally in Virginia, Pennsylvania, Carolina, and Japan, rising with a strong woody stalk to the height of twenty feet and upwards. An incision being made into the tree, a whitish yellow juice, which has a nauseous smell, comes out between the bark and the wood; this tree, though it is noxious to some people, yet does not in the least affect others, and therefore one person can handle the tree as he pleases, cut it, peel off its bark, rub it or the wood upon his hands, smell it, spread the juice upon his skin, and make more experiments, with no inconvenience to himself; another person, on the contrary, dare not meddle with the tree while its wood is fresh, nor can he venture to touch a hand which has handled it, nor even to expose himself to the smoke of a fire which is made with its wood, without soon feeling its bad effects; for the face, the hands, and frequently the whole body swells excessively, and is affected with very acute pain; sometimes blisters arise in great plenty, and make the sick person look as if he was infected with the leprosy. In some people, the external skin peels off in a few days, as is the case when a person has scalded or burnt any part of his body. Nay, the nature of some persons will not even allow them to approach the place where the tree grows, or to expose themselves to the wind which carries the effluvia or exhalation of this tree with it, without letting them feel the inconvenience of the swelling just described.

Their eyes are sometimes shut up for one, two, or more days together, by the swelling. I know (says the Professor) two brothers, one of whom would, without danger, handle this tree in any manner he pleased, whereas the other could not come near it without swelling. I have known old people who were more afraid of this tree than of a viper. In some places this tree is rooted out on purpose, that its poison may not affect the workmen. The natives are said to distinguish this tree in the dark by its extreme coldness to the touch, and the inspissated juice of this tree is said to be the fine varnish of Japan.

If the ash trees in this country had been of this kind, I for one would long ago have been burnt to a cinder. It would appear that our forefathers had a very particular veneration for the ash tree, as it is to be found about all the old farm houses and old church-yards or burying-grounds in the country. I can safely say with Spencer in his Fairy Queen, viz.

I know "The ash for nothing ill."

THE ALDER.—*Its Nativity, Soil, Situation, Purposes, Value, and Seasoning.*

The alder, like the birch, is said to be a native of the mosses of Scotland, and marshes of England, and some say it is originally from Holland; in all the course of my profession, I have seldom seen the alder dug out of the moss, as the oak and fir often is. It is to be found plentifully in the marshes amongst the coppice in the Highland woods.

Soil.—Its proper soil is a rich black mould where there is great plenty of moisture; it will grow too in ordinary dry places if the soil is deep; if from the plant, in places of this kind it does not live long, soon gets empty in the heart and decays; if cut from the natural stool it will live longer, and grow to a good size if its gets room.

Situation.—The most proper situation for the alder is in flat marshy boggy places, or by the sides of rivers, and so much the better if the water sometimes floats over the ground amongst the roots, or beside stagnant water. It will thrive well, and it may with profit be planted in such places as cannot be properly drained, as then it will grow to a timber tree, when no other tree will, and will produce a fair rent for land that is not capable of being even pastured or turned to any other account. In such places the alder is easily propagated from layers; it takes with this method very freely; the shoots take root immediately, and it bears transplanting well.

Purposes and value.—The bark of this tree was once used by the dyers for dying black; but it is now out of use amongst the dyers for that purpose, although a little of it is sometimes in use amongst the peasantry for dying coarse cloth of their own manufacture; therefore, the bark may now be considered as adding no value to the alder tree. It is only valuable in a coppice wood, as growing in places where oak will not, and when cut as a coppice tree its timber is used and cut up into barrel staves. (See the use of small wood for coopers, elsewhere in this work.) When the alder is used as timber it is chiefly for piling, as it is said to last a long time under water; some go the length to say that the alder hardens by degrees under water, till it becomes a kind of stone. Although I do not go the length to believe this, I am well aware that the alder will last a very long time in piles when always kept under water; but when wet and dry by turns it consumes very fast. We read in old authors that the alder wood was made the foundations of bridges and other buildings in boggy ground, and it stands on record that there is a great deal of alder used under the Old Bridge at London, and under the Rialto at Venice. When the alder is required as a timber tree above the size of stave wood, say to square from seven inches and upwards, it sells at a shipping port at 1s. 6d. and 1s. 10d. per solid foot, and for stave wood, at 10d. and 1s. per foot.

One acre of alder coppice, at the age of twenty-four years, say for stave wood and charcoal, will be worth from L.25 to L.30 sterling; but to make an acre of alder wood valuable, it should be reared up to thirty-five or forty years; in this case it should always be reared from the stool, after having been once cut over as a coppice, as there can be three times the quantity got on the ground, and it will be a great deal larger at that age than from the plant. The timber of one acre of alders, properly reared up in this way, to the age of thirty-five or forty years, will be worth from L.70 to L.80 sterling, and this gained on land not fit for any other purpose.

Time of cutting.—The alder, in order to retain all its qualities as timber, should be cut in the months of November and December, and the bark clean stripped off it, as by letting it remain to season with the bark on it, the bark gathers a vermin of worm and destructive insects betwixt the wood and the bark, that very soon destroys the timber.

Seasoning the timber.—The most advantageous method of seasoning the alder is to strip it of its bark in April, or as early as the sap gets up to make the bark come freely from the tree, and allow it to stand till the month of November, when it may be cut down and sawn up; this makes the timber of the alder much more hardy and durable; but it must be here observed that, by this method, the growths from the stools are oftentimes lost. The alder should never be either driven for piles, or used in gate posts, with the bark on it, or the natural sap in it. The most effectual and profitable method of seasoning the alder is to put it into the stove, as directed with the ash, and extract the natural sap, and dry it throughout; and this will make it immediately fit for use, the timber much more durable and hardy, and will last three times longer either above or under ground.

I may here observe, before dismissing the alder, that where the whole plantation is alders very little inclosing is necessary, as the leaves and young shoots are so ill tasted that there is no cattle, sheep, nor scarcely any other creature will eat or crop them. This renders the alder a very useful tree to plant about the sides of rivers to defend the banks, where the inclosing would be expensive; and, besides, its roots are stronger and more interwoven with each other than any other tree. From the situations in which the alder can be propagated, it is a tree not unworthy the planter's notice.

THE BIRCH.—*Its Nativity, Soil, Situation, Purposes, Value, and Seasoning.*

Nativity.—The birch is a native of the Highlands of Scotland, and as such I am chiefly to direct the attention of the forester, although the same species, differing little, is to be found in Lapland, Russia, Sweden, and in America; from the latter place large quantities, commonly called the black birch, are yearly imported into Great Britain, so that in America it appears, as in Scotland, they grow natural, but to a much larger size, which is chiefly owing to the soil, their age, &c.

Soil.—The birch tree in this country seems indifferent to all kinds of soils and situations. It will grow and live on sandy hills and in the rottenest bogs, in the wetest marshes and in dry hedge rows; no ground is too barren for it, whether it be gravelly, stony, bare rock, chalky, or whatsoever, the birch thrives upon it.

Situation.—The birch will grow as a coppice tree when cut, or in the most exposed situations; and for this purpose it is most common in the

Highlands of Scotland; and as the bark of it is used in tanning, and the timber used in barrel staves at the age of the cutting time, in this case it forms no very inconsiderable part of the coppice. The birch will also grow as a timber tree in low wet situations, such as the alder, and may in these places be profitably reared as a timber tree.

Purposes and value.—The small birch, when cut at the age of oak coppice, is used as barrel staves, for which purpose the cooper's esteem it more than any other home-grown timber; when delivered at a shipping place for this purpose, it sells at 1s. and 1s. 3d. per foot. The small brush of the birch makes excellent charcoal. The birch, when reared up as a timber tree, is useful for many purposes; it is a tough cross-grained kind of timber, and not easily split; in this case it makes fine harrows for the farmer, and many other purposes of husbandry; all the ploughs and carts in Scotland were at one time made from it. When arrived at maturity, as a timber tree, it makes very excellent common bedsteads and chairs, and is much more durable than the black birch from America. I have also seen very fine variegated tables and press pannels made from it. It is also used by turners and last makers. I have often sold birch at and above eight inches square for these purposes, at 2s. 6d. per foot; but 2s. is now about the average price. I do not think this tree, although it will, like the alder, grow in the same kinds of wastes, so profitable to be reared as a timber tree; but it is much more as a coppice tree, in situations of coppice ground where oak will not grow, as the bark of the birch sells at half price of the oak bark when properly prepared. The ancients wrote on the bark of the birch tree instead of paper. The tops or twigs of the birch make excellent brooms, and sell well when near large towns. Wine is often made from the sap of the birch tree, and it bleeds more freely than any other tree, and its juice the best of any for this purpose. The time of tapping this tree is in the beginning of March; the juice, which runs freely from the wound, is of a very pleasant taste, and when worked up with sugar or with honey, which is best, makes that agreeable liquor called birch wine or birch mead. There are two ways of getting the sap; the one by boring a hole in the tree, and the other by cutting off the ends of some of its branches. When a hole is bored in the trunk, a piece of chip is to be set in it to guide the sap into the vessel put to receive it; when the ends of the branches are cut off they are to be let into quart bottles, a number of which may be hung on one tree. The sap runs most freely in the middle of the day, and in warm weather; a south or west wind sets it a running, and a north or east wind stops it, or makes it run slowly. This, when made into wine, is a pleasant and wholesome drink, and some say it has a considerable effect in sweetening the blood and curing the scurvy.

An acre of coppice birch, at twenty-four years old, wood and bark, will be worth from L.30 to L.35 sterling.

An acre of birch timber trees, at forty years old, will be worth, wood and bark, about L.90 sterling.

Seasoning.—The birch is in general barked standing in summer, and cut down in autumn ; and, indeed, this should always be the case, as its timber is so liable to rent with the drought ; there is no preserving of it otherwise, unless into houses, or steeping it many months under water ; or if the timber of the birch is to be applied to any particular purpose, it should, so soon as cut down and stripped of its bark, be put into the stove and seasoned. For the method of barking the birch see another part of this work. The proper time for cutting down the birch is the last fourteen days of November, and first fourteen days of December, as no tree abounds so much with sap in the growing months as the birch, but when the bark is to be preserved, it must be barked and cut as above.

THE BEECH.—*Its Nativity, Soil, Situation, Purposes, Value, and Seasoning.*

Nativity.—The beech is undoubtedly a native of England. The ancient authors say there was no beech in England at one time; but this has been proven by more modern writers to have meant the elm. The beech is a most ornamental tree, and next to the oak and Spanish chesnut in this point of view, and worthy the planter's notice.

Soil.—The natural soil of the beech is a dry, light, and warm land. Richness of earth it does not at all require, which is of advantage to the planter, as he should at all times have a due regard of suiting his trees to the soil. The beech will thrive in the most dry sandy soils, or among raw gravel or stones, nay, almost upon rocks. In many places in England, and also in Scotland, good growths of beech are to be seen, where one is astonished to conceive whence they have their nourishment; but upon examining their roots, the wonder ceases, as they are found to penetrate to a great depth, and to spread a vast way when arrived at places where there is moisture and nourishment, as many other trees' roots do immediately under the surface of the ground.

Situation.—I have been told the beech grows to a great size on the hills in some counties in England, such as the hills of Surry and Kent, upon the Cotswold and Stroudwater hills in Gloucestershire, and flourishes exceedingly upon the bleak banks of the Wye in Hereford and Monmouth shires. In all the hills of Scotland where I have seen the beech, and also in Ireland, particularly on the sides of the hills at Tolleymere park, I have never seen them grow to any valuable size as timber on or near the tops of the hills; but on the sides of the hills, and indeed fully half way to the top, provided there is groups of trees above them, I have seen them thrive and grow to a very considerable size; but I have never, in all the course of my professional knowledge, seen them arrive to any considerable size or value as a timber tree on the very tops of hills nor in extreme exposures, and even in ordinary exposed situations it grows slow; but when well sheltered, and in its natural soil, it grows fast and to an immense size. This tree, when singled out by itself in a park or lawn, is a most beautiful picturesque tree; nor is it deficient of beauty in a grove or plantation, as it variegates its leaves, and is longer than most other trees of throwing off its foliage. It is not a good tree in the exposed side of a stripe or belt of planting, as it generally, in this situation, gets a bare and bad top on the exposed side. The beech will live to a good age in its own natural soil, but in a cold damp bottom, although the subsoil and the situation be good, it will not live long; hence in many parts of Ayrshire, and others of a like nature, they die before they be forty years of age. I could give many instances of well laid belts and stripes of ornamental planting, almost completely extirpated in a few years, for want of a proper attention to plant such trees as will agree with the soil and situation. The advantage both to the public and to private persons would be very great, if the planter would pay a proper regard to what nature directs in their plantations of timber trees. Each kind has its natural and proper soil, in which it will always thrive; and there are so many kinds of them, that one or other of them will agree with any soil a proprietor can have; and I will clearly prove, that great advantages will be gained by rightly planting any of the kinds I shall treat of in their proper soils and situations. It is astonishing that many people, when about to plant (without taking advice) will frustrate their own expectations by suiting the trees to their particular fancy rather than to nature. These gentlemen planters contradict nature, and then wonder they have not success; they will not be advised how to succeed, and when they fail by their own obstinacy and ignorance, they cry out, who would plant, when besides (say they) the length of time, the success is so uncertain. Let the gentleman who is about to enter on a process of planting, first have a proper system laid down to him from experience, and he will save much expense, and insure success.

Purposes and Value.—It has already been shown, that the extensive importation of all kinds of hard wood from America into this country, has rendered some of our home-grown hard wood trees of very little value. Of these kinds the beech is one. Unless where the beech can be reared up to a large size, and to have a tall clean stem, it is scarcely worth the planter's rearing as a profitable timber tree. The beech timber will last a long time when cut up in a proper state and kept always dry, or when kept always under water; but wet and dry alternately, it is worse than the birch or alder. Beech makes good piles when always under water; and from the hard and stiff nature of their timber, they will stand the driving into stiff clay or gravelly ground better than many other trees. The beech will also last well in ship's-keels, or plank, keeping them always under water; and trees for this purpose must be of a large size. Trees that will suit these purposes must be such as will square from ten to eighteen inches, and from twenty-five to sixty feet long. Such trees will sell at 4s. and 4s. 6d. per foot; trees from seven to ten inches square, and from twelve to twenty-five feet long, will sell for 2s. per foot; all under that size from 9d. to 1s. 3d. per foot. Small beech is used for charcoal, and drying malt for making porter, and sells for that purpose at 15s. and 20s. per ton, deliverable at the works. The beech is of no use as a profitable coppice tree. Before the beech be profitable, and meet a ready demand as timber, it will require to be from sixty to eighty years old; but the value of the tree depending on its cleanness and straightness of stem, it can be reared up to that age much closer on the ground than many other trees. As the beech must be trained up straight and tall, 200 trees may be reared on an acre of good land to sixty years old. An acre of beech trees reared up to sixty years, where the soil and situation is suitable, will be worth from L.450 to L.500 Sterling.

Seasoning and felling.—The beech should always be cut down from and after the first day of November, till the fifteenth day of January. After being cut down, the bark should be taken off if not wholly, at least a strip off four sides of it, and laid on dry bare ground, where no grass grows nor water lodges, raised a little off the ground on blocks of wood or stone, and to lie exposed to the weather for not more than four months, and cut up in the month of July, and the planks put into an open shed, always kept from the wet, but exposed as much as possible to the wind and drought; and in other four months or so it may be used; according as the planks are of thickness it may be a little sooner or longer. The beech tree should never, after being cut down, be allowed to lie on the damp ground, nor amongst grass, as it in this case soon musks and becomes quite short in the timber, and soon worms. I have known the timber of a large beech tree that was cut in the month of March, (six feet in girth,) allowed to lie amongst long grass, and in a damp place, for only three months, and when taken up the timber was almost useless. When the timber of the beech is to be used for any particular purpose, it should always be cut up with a little of the natural sap in it, and then dried as aforesaid. In this case it is most durable.

THE CHESNUT.—*Its Nativity, Soil, Situation, Purposes, Value, and Seasoning.*

Nativity.—We will begin with the Spanish chesnut; and in doing so, its name at once declares its nativity to be that of Spain, Portugal, the Netherlands, the Alpine mountains, and Sicily. But although this tree be a native of Spain, it is well known to grow to an immense magnitude, and to live to a great age, in Great Britain and Ireland; and in those countries, too, when it agrees with the soil, it grows very rapidly, more so than many other of the hard wood trees, and of course comes sooner to be valuable timber. This tree, too, answers well as a coppice tree, as it grows much quicker from the newly cut stool than the oak, and as an ornamental tree it is equal, if not superior, to the oak and all other forest trees. That there are a number of very large old beautiful trees of this kind in the three kingdoms, is a fact, but that there are so very few is surprisingly wonderful. When our forefathers saw with what grandeur and rapidity this tree shot its top to the clouds, and in so short a space of time arriving at such lofty and sublime magnificence, and with all the value and usefulness of its timber, why they did not plant many more of them, is a crime bordering on wilful insanity, as these trees are much easier propagated and equally valuable as the oak. (For a more particular account of this tree see my Miscellaneous Reports.)

Soil.—The Spanish chesnut will grow in almost any soil that any other tree will grow in, and come to maturity as a timber tree in many soils that other trees will not. I know no soil that the Spanish chesnut will not grow and thrive in, excepting a very cold clayey bottom, where the water will not run off, and when the clay is very near the surface, and when the water stagnates above the roots. In every other soil it may with success be planted.

Situation.—This chesnut will grow in all situations that any other tree will grow in. If cut over as a coppice tree and left to grow from the stool, it will grow on the most bare, cold, bleak, and exposed situations, and will make equal progress with the oak, and often superior in quickness of growth, even within the lashings of the spray of salt water. This chesnut, too, will grow excellent, like the oak, by laying the young shoots from the old stool. This tree may be propagated by young suckers. Take a young sucker from the root of an old tree, of which there are generally numbers; cut it off with the bark whole, and a little of the wood of the root at it, which can be done by nicking a little in both sides of the sucker with a saw, then take out the piece at the end of the sucker, plant it, and it will take root immediately, and grow. This must be done in winter, when there is no sap in the bark, for fear of separating the wood from the bark. In this case the Spanish chesnut is the easiest of all hard wood trees to propagate.

Purposes and Value.—The timber of the chesnut is excelled by none except the oak, and with this too it stands on an equal footing, as it will answer all the purposes of the oak. It has been very falsely represented by some authors, affecting to bring its timber into disrepute, saying, that it grows shaky, and that its timber is brittle; this is only the case with it when allowed to stand beyond its maturity; and its beauty, as an ornamental tree, often brings it into this state; as all trees, when past, as it were, the meridian of life, the oak itself not excepted, begin to fall into decay; but take this chesnut at the age of from 80 to 100 years, and at this age it is arrived at its maturity, and is a large size, fit for any purpose, and at this age there is not a better timber tree. Like other trees, there will be diseased ones amongst them, but this is not the case in general. We may as well argue, that because a few men in the country are affected with a malady, that the whole country is diseased. I have seen Spanish chesnut trees cut down, whose age was traced to 130 years, and their timber was excellent. To give one example, in the year 1801, I sold some oak timber to the manager of the Forth and Clyde Canal for making their lock-gates, amongst which were two trees of Spanish chesnut, which was sold to me along with and for oak, and was cut and barked at the same time, in the month of June; when Mr. Steen, the company's overseer of carpenters, came to the wood to mark off the trees for cross-cutting, the chesnuts being two fine trees, (I may here observe, by the way, that the Spanish chesnut is very like our oak in the timber) Mr.

Steen marked them off, taking them for oak. They were sent to the canal; I kept a private memorandum of the two trees; their numbers in the scantling book were 27 and 33, &c.; the one was 22 feet long, and squared 12 inches in the middle, and 10½ inches at the top; the other was 18 feet long, and squared 17½ inches in the middle. In the month of September, after I called on Mr. Steen at the work, who had put his men to work up the two trees, when he for the first time discovered that they were not oak, and was for throwing back the trees. Mr. Baird, the engineer, who had the oversight, was consulted, and through persuasion he allowed them to be put into a new gate; both trees were used nearly all the size they would work to, the one made what is called a mitre post, and the other a turn post; the rest of the gate was finished with the best of red wood oak; the gate was put into its place, and at use in spring 1802. In the summer of 1827, when the gate was overhauled and got some repair, the two pieces of chesnut were as hard, firm, and solid in all their parts, as the first day they were put in, and some of the oaks had to be replaced; this too in fresh water, and alternately wet and dry, which is much more trying than in salt water; in this place they have stood the test for twenty-five years, and I have little doubt but they may stand other fifty years more. I am bold to aver, that the Spanish chesnut will make as good ship-building timber as the oak, and that the most of the Spanish ships are built of them; at least, that they are indiscriminately used with the oak in building, is plain from the simple fact, that I went on board of a new Spanish ship at the London wharf in the Thames, called a galliot, or some such name, and conversed with the captain, and examined the beams and plank, and found many of them to be chesnut; and he told me they preferred it to the oak in most cases. This chesnut, too, makes excellent tables, book-cases, landry-presses, and wardrobes. It is also often used in place of wainscot; it takes on a fine polish; it is also excellent for wines and spirit casks; it will do for every purpose that the oak is used for. It should never be forgot by the British nation, and all growers and rearers of timber, that it can, like the oak, be reared from the old cut, stool, or root, and trained up crooked to any shape, as the oak, to answer ship timber. The value of the chesnut has not kept pace with the oak; its bark only sells about half the price of the oak, nor does its timber bring such a high price, not yet being in general use in ships. The price of Spanish chesnut timber in trees, to square eight inches and upwards, is 2s. 6d. per foot, and when under that size, for barrel staves, and ends, 1s. 6d. and 1s. 10d. per foot. As the chesnut cannot, from the low price of its bark, be either with propriety or profit reared in general as a coppice crop of trees, therefore, in all places, they should always be reared up to maturity as useful timber trees; as the chesnut grows very fast, it will be an excellent useful timber tree at fifty years; at eighty, it is at maturity, and will answer all purposes.

Let us suppose an acre planted with Spanish chesnut at nearly twelve feet apart tree from tree, and reared up as described in the Section Planting, to the age of fifteen years, as the roots will be of sufficient size by this time to rear up three trees from each, suppose the whole to be cut over. As the bark is not so valuable as the oak, and the timber at this age only fit for barrel-staves and charcoal, and not a full crop planted, the acre at this time will only be worth from L.20 to L.25 sterling; but we suppose the acre is properly cut, the stools dressed up for the growth, and thinned out as directed in Section XI. of this work; and here, to make a proper and useful crop of timber trees, say the stools must be thinned out to three stems or shoots on each stool. At the age of twenty years, the one half of the whole stools must be cut over, as there are three trees to one on the ground at this cutting, although leaving the half of the stools untouched, which must be equally divided on the ground. This cutting will be worth at least L.40 the acre;

we have here still 200 stools with three shoots, or trees from each. Again, at the age of forty years, the middle tree of each stool is to be cut away, which will at this age, say forty years, be worth at least L.2 per tree, which, for 200 trees, is L.400 per acre, and leaving 800 on the ground besides the young coppice. Observe, that now on the 200 old stools there are 400 trees, these or all, if attention has been paid them in rearing up, as in the explanation of Plate 16th, &c. for ship timber, and allowed to grow to the age of 70 years, this is 30 years more growth, when they will have made great progress, and by this time be fit for shipbuilding timbers of all descriptions, and many of them will have from one and a half to two tons of timber, and on an average will be worth L.5 per tree, which for the 400 old trees is L.2000 per acre, and still a value of at least L.450 on the acre of young trees, which are always coming forward; and makes an everlasting cutting at every 20, 40, and 70 years, bringing in an immense sum, besides being trees of the greatest ornament. What proprietor is there that would not set aside one or more acres of land to the rearing of the Spanish chesnut, the most magnificent and beautiful tree in nature, and its fruit good for the food of man and beast? (See Miscellaneous Reports.)

Seasoning and Felling.—As the Spanish chesnut is like the birch, it nearly remains full of sap all winter; for the sake of the timber, it should be cut down in November and December; but this tree, for the sake of the bark, is often cut down with the oak and barked at the same time. The timber of this tree, as well as that of the oak, would be much more tough and durable if it was barked standing in the month of May, and allowed to stand for fifteen months, say till the months of August or September twelve months after, at which time it may be cut down and immediately cut up or wrought into any piece of work as a whole piece, without farther seasoning, by which means the strength and durability of the timber are retained in their most perfect state. This, however, will not do well when another crop is to be reared from the stool or root as aforesaid. The best and most effectual method of seasoning the chesnut and the oak, when cut down in summer for barking, and when the trees are to be used for any particular purpose in ship-building, &c. if they cannot be got to a steam seasoning stove, such as described in the article Ash, is to take the logs or timber to be seasoned to dry hard ground on a rock or hard road, &c. raise the logs or trees a few inches above the ground, cover them all over and underneath with hot limeshells, and slake the shells about them with water. The whole timber must be covered with the limeshells, allow the timber to lie amongst the hot lime for ten or fourteen days, when fresh shells may again be applied, and the operation repeated in all for three times; this will take the natural sap most completely out of the white or sap wood of the tree, and make the white or outside timber of the chesnut and the oak equally as hardy and durable as the red wood or heart of it is. If the timber is to be used in ship-building or in any other way in a whole piece, it may be immediately applied to the purpose intended after being steamed; if the timber could be dressed up and shaped to the purpose intended for it immediately after being cut down, (which by the way is much easier done than when the timber is allowed to harden) it should be done before being steamed with the lime.

The steaming of timber with hot lime immediately after being cut down, (particularly the chesnut and oak) when the pores are all open and the natural sap circulating through every part of it, will be found the most efficacious and effectual remedies yet known for hardening and toughening timber cut down with the sap and preventing the rot. It may also be done with good effect and great propriety to the timber, when cut up into scantlings or boards in a green state, for whatever purpose it may be intended. Before dismissing this tree, I may mention an anecdote of my grandfather, who was esteemed in the neighbourhood where he lived, and I believe truly, a very religious man; I mention his name because I have only heard the same story from one other person; "that the ships of the Spanish armada* were all built of this timber tree, and that whoever kept any of them growing on their estates, or planted any, were accounted rebels or Roman Catholics." Be this as it may, one thing we are sure of, that there are very few estates in Scotland where there is a single old Spanish chesnut to be seen standing, and even on these there is only one or two solitary trees to be seen. It is only within the last very few years that almost any of them have been planted. The quality of their timber, their beauty, and the rapidity of their growth, must make them a tree to be desired.

HORSE CHESNUT.—*Its Nativity, Soil, Situation, Purposes, and Value.*

Nativity.—The horse chesnut is a native of the East Indies and Asia, but grows well and to a large size, and lives to a good age, in this country. It throws out its branches to a great width, yet forming a close thickset head, which when left to nature and on a good soil, takes a most beautifully striking parabolic form. Amongst the largest I have ever seen, and which are trees of a most surprising magnitude, are a few on the estate of Ingliston, the property of J. Gibson Craig, Esq. about eight miles west from Edinburgh, on the Mid Glasgow road. There is no tree amongst the whole tribe half so beautiful as the horse chesnut; as an ornamental tree, it is of the first class, from its beautiful flowers in spring. I am surprised it is not more planted.

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* A Spanish fleet of ships which came to invade Britain, loaded with chains to take all the Protestants over to Spain, to behead or enslave them, which fleet was destroyed in a most miraculous manner by a storm at sea; and, it appears, mostly all religious Protestant proprietors took vengeance on this tree, and cut them down; and some go the length to say, that in place of using they burnt their timber.

Soil.—The proper soil for the horse chesnut is a rich light earth, but it will even grow in sandy, gravelly, or stony land.

Situation.—This tree will grow on the sides of hills, where they are screened by other trees above them from the severity of the storm. As they are not profitable to be reared as timber, their only situation is in the pleasure grounds or fields for ornament.

Purposes and value.—The sole purpose of rearing this tree is for ornament, as its timber is neither useful nor valuable; but its value as an ornament to a lover of ornamental trees is indescribable. The timber of it, when it becomes necessary to cut it down, is only worth 1s. 6d. per foot; it is useful for some of the purposes that limetree and poplar are used for; say boards for carts and wheelbarrows, &c. and can never be reared with advantage as a profitable tree. The quick growth of the young branches of this tree is very surprising; at the shooting season they will all uniformly grow an inch in a day and a night, but this will appear the less wonderful when we examine the tree more strictly, for we find that the whole growth of a year is performed in about eighteen or twenty days at the shooting season, all that it does afterwards only gives the young growths strength and firmness.

Although not in order, we shall next take the oak, because from its affinity to the Spanish chesnut, a reference to it in many cases will be given, and it will save the trouble of turning over many leaves.

THE OAK.—*Its Nativity, Soil, Situation, Purposes, Value, and Seasoning.*

Nativity.—The oak is said by some authors to be a native of Devonshire in England. The common oak, although there are varieties, is allowed generally to be a native of England, and commonly called English oak. I should suppose, however, it may with equal propriety be called a native of Scotland and Ireland. It appears to have been an inhabitant of Highland dens and mosses of Scotland from time immemorial. We may venture to infer, that the existence of those truly venerable trees commenced centuries prior to the era of Christianity.

Soil.—The oak, as we have said before, will grow and thrive on almost any soil. It grows in the most barren, rocky, sandy, clayey, and stony soils,—any soil but where there is too much wet. The oak that grows in clayey soils is most commonly best hearted; that is to say, there is most red wood in the tree, but the timber is more free than that which grows on rocky soils.

Situation.—The oak will grow and thrive in all situations, as well as in all soils. If care is taken in the rearing, it will grow on the highest hills, in the most exposed situations, either to the most ruffian winds, or by the sea-coast, exposed to the lashings of the salt water, and in the dens and the valleys. I know of no situation, at least as far as I have travelled in the three kingdoms of Great Britain, but the oak may be reared upon. I have observed instances of oaks growing freely for twenty successive years, and at this time or age come to a stop, and for other ten or twelve years more made little or no observable progress, barely kept alive,—after this take a new growth, and continue in their usual way, increasing visibly in height and thickness. This, though seeming to arise from some hidden cause in the tree itself, is oftener owing to the soil. The tree at first being planted into a good earth; or subsoil, spreads its roots and flourishes extremely well, so long as they remain within the compass of that coat or layer of good ground, but when they have pierced through that, and got into some other starving and poor earth, they receive little nourishment, and the tree comes to a stand; this is particularly the case with the oak, as it sends its roots very deep, more so than any other tree, and the larger the tree grows it requires the more nourishment; and it would continue so along till the tree dies, were it not that the roots pushing deeper still, and farther, till they again find good soil. In this case the first good soil keeps the trees growing for the first twenty years, and affords them nourishment, so that they grow freely till they penetrate into some unfavourable layer, then they are kept for some years and barely live, till their roots again get into the good soil, and again the trees begin to grow. Often times I have heard the trees considered as dead when this was the case; whenever a soil of this kind is supposed to exist, the trees, though sickly and stinted, should be spared for some years at least, till it be seen if they will recover.

Purposes and Value.—The thousands of purposes to which oak timber may be applied, were we to enumerate them, would take a volume of themselves; all its most particular and ordinary purposes is already noticed in this work, and will be seen elsewhere; suffice it to say, that the timber of the oak may, with propriety, be used into all and every purpose that timber can be applied to. The value of the oak too, as a profitable coppice tree, has been dwelt on, and most particularly pointed out in acres and otherways, in other parts of this work. But we must here consider its value and profit in rearing it up as a timber tree to maturity. The oak is allowed not to be at its maturity till it be one hundred years old; and it is a common saying of the oak, that it will grow one hundred years, will stand without the least decay for another hundred years, and it will take a third hundred years to decay. But oaks, like the Spanish chesnut, have been traced to nearly one thousand years standing. Now let us see the value of one acre of oaks reared up to maturity, and the most speedy and profitable method of rearing them; suppose we plant one acre with oaks, at about thirteen feet six inches, plant from plant, this will be three hundred trees to a Scotch acre. I must here observe that the oak requires rather more room than the Spanish chesnut, so that we shall allow fifty trees less to the acre; these three hundred trees are reared up to the age of eighteen years, by which age the diameter of the roots will be such as will rear three shoots from each of the three hundred trees to be cut over—

value at this cutting will only be about L.25. The stools are to be dressed up for the growth, thinned out the year after being cut, as directed in the Coppice Thinning Section, to three shoots from every stool. The whole of these are to be reared up for ship-building timbers (as directed by the Plate 16. See its explanation.) At the age of twenty the one-half of the whole stools is to cut down, dividing the standril stools as equal on the ground as possible, taking care also to leave the most promising, healthy, and thriving of the stools, carefully training them up for timber, as in Plate 16, to the age of forty years. I must observe that at this cutting of twenty years we have (although only cutting the one half) three trees from each stool, which is 450 trees cut for the half, whose value may be fairly stated at L.40, and we have standing 450 trees on the acre, the stools of which are distant from each other about 19 feet; these trees having now plenty of room to branch out, will make great progress, and the whole 150 stools, with three trees on each, is to be trained up as in Plate 16, Figure 1st, to the age of 40 years, when the middle tree is to be cut out. We will suppose these trees at this age to be from 12 to 20 feet of timber; but, not to overrate them, we shall call them only 12 feet each on an average, which, at 5s. per foot, wood and bark, is L.3 per tree, L.450 per acre, and twice as much on the ground from the other two trees on each stool; besides the coppice again arrived at other 20 years, from which other three trees on each stool is to be reared up to 40 years, and the two trees on the oldest stools are to be reared up other 40 years, which brings the oldest to 80 years; and here, at this age, we have two trees from each of the 156 stools, say 300 trees at the age of 80 years, trained up for ship-building, as in Figure 1st, Plate 16, and fit timbers for any ship now from one to two tons of timber in each tree, worth at least L.8 per tree; which is L.2400; and we have the other trees as above at 40 years old L.450, and the coppice at 20 years old L.40, in all L.2890 per acre, and alternate cuttings every 20, 40, and 80 years, without any expense but keeping good the fences after the cuttings. Where is the proprietor so blind to his own, and the interest of his posterity, that would not devote one or more acres to such a lucrative concern? nor have I at all exaggerated the price or value. Government, and even merchant ship-builders, are paying a higher price at this present time for crooked oak timber of the sizes than I have estimated them here at,

Seasoning and Felling.—As the bark of the oak carries in it such a proportion of the value of the timber as a profitable crop of trees, it is not to be supposed that any wooded proprietor would make a sacrifice of it although the timber would be bettered to cut it in winter, as the proper time for felling the oak is from the first day of November to the middle of January. But the next best method to retain all the strength and durability of the timber, is to bark it standing as the Spanish chesnut, and allow the oak to stand barked from the month of June, when it should be finished barking, till the month of August and September 12 months after; but this too would interfere with the growths from the stools of the oak, and would be a most serious loss. In order, then, to season the oak timber, supposing it to be cut down, as is customary in summer for the sake of bark, we must have recourse to art, in place of allowing it to season by natural means; and here I would again recommend the steam stove as the most ready and effectual method, as the stove will season it immediately after being cut down, either when its timber is to be used as a whole piece, or cut up into planks, &c. and it may be cut down the one day, steamed the second, and put into work the third; next to the steam stove is the hot lime. (See this explained in the case of seasoning the Spanish chesnut.) Do with the oak in the very same manner; the hot lime extracts the sap and hardens the timber, and may be advantageously used after the oak is squared up or planked up into the purposes it is intended to be used for, provided the scantling or planks be not less than two inches in thickness. If the oak is to be used into thinner boards, it must be steamed before cutting it thinner, as it would be apt to twist and warp; and if very green and full of natural sap, when put into the stove in two inch planks, there should be a piece of wood nailed along the ends of the planks, to keep them from splitting, before putting them into the stove.

THE ELM.—*Its Nativity, Soil, Situation, Purposes, Value, and Seasoning.*

Nativity.—There are a great many kinds of elm, some have enumerated twenty different kinds, and most authors have agreed, that there are eight different kinds; of these, say they, are the true English elm, the narrow leaved Cornish elm, the Dutch elm, the Black Worcestershire elm, the narrow leaved Wych elm, the broad leaved Wych elm, the upright Wych elm, and the Witch elm. By whatever name a connoisseur in botany may term them, they are all elm, and nearly all of the same quality of timber, with the exception of what is well known amongst Foresters and Planters, the Scotch, English, and Dutch elm; these three kinds, whose names at once distinguish their nativity, differ a little with regard to the qualities of their timber. We consider, suffice it to say here, that the Scotch elm is by far the best, toughest, and most durable timber. The timber of the English and Dutch elm is nearly alike as to quality and value.

Soil and Situation.—The soil the elm lives and thrives best in is a good rich mould; and the situation somewhat low, or level ground, with plenty of moisture, but not over wet. The elm is by no means a good tree for hill ground, or where there is a stormy exposure. The elm will grow excellently from the old cut stool, or from layers, but it is not a profitable coppice tree, yet it will grow much faster from the natural stool than from the plant. It is a hardy tree, and full of life; but it requires a great deal of nourishment—no tree, the saugh not excepted, more. It will send out its roots a long way in search of nourishment, but if not supplied in plenty, it will grow slow and become stunted; hence we always find the elm succeeds best in hedge-rows and avenues, and although pretty close the one way, having two sides to branch out on, they will grow fast when the soil and situation suits, and to a large size; in such a soil and situation the elm will grow to a great size as a single tree. In the soil and situation the elm loves it has been known to grow to such a size as to girth ten feet in sixty years. Let it be here observed, I am speaking of the three kinds of elm indiscriminately, as they will all grow alike well in such soil and situation. The propagation of the elm is in general very easy, especially the English and Dutch; it can be raised any way that any other tree can, and, like the willow, will grow from fresh poles, if stuck into the earth at a proper season. These two kinds, too, may be raised in great abundance by burying a piece of fresh branch in the ground at a proper time of the year. If the soil is good, all the three kinds can be raised easily by layering. Some have even gone the length to say that a chip of the wood of the elm will grow, but this is carrying the matter too far, by proposing an utter impossibility. I recollect of planting a young shoot from an old elm tree, after it had been three years cut down and lying in the timber-yard, when the sawers were going to cut up the tree, they began to hack off the bark. I gathered up a chip of the bark from a knot of the timber to which was attached a little of the timber. From the bark was a fresh bud or small shoot about one inch in length. I planted, which happened to be the 24th of August, and by August twelvemonth after, there was a growth of four feet three and a half inches, and it is now a tree twenty feet high; thus the elm, like the saugh, keeps its sap long after being cut down.

Purposes and Value.—The elm as a timber tree is suitable for many and valuable purposes, and here I must draw a line of distinction betwixt the Scotch and English and Dutch elm. The Scotch elm is by far the most valuable as a timber tree; its timber is much more tough, hard, strong, and durable than the English or Dutch, and the English has still the advantage over the Dutch as to quality of timber. The English and Dutch elm often grows shakey, and often after a few years grows in some soils hollow in the heart. There is a great deal of elm used in ship's keels, and for planks under water; and for which purpose all the three kinds is used, but the Scotch is always preferred. Elm, too, is always preferred to any other kind for cart and carriage wheel naves, and for this the Scotch is invariably used and preferred; the other kinds being too soft and free in the wood. The Scotch elm will answer for almost any purpose, particularly in husbandry, that the ash will do for. The Scotch elm can be reared, and is to be found in England and Ireland in abundance, and its superior qualities are well known; when this elm is about the sizes, and sold alone for carriage wheel naves, it sells at 4s. and 4s. 6d. per foot; when used in common country purposes 2s. 6d. per foot. The English and Scotch elm, for ship-keels and plank sell at 4s. per foot: the Dutch elm will do well for pipes under ground. Great quantities of elm are used by the cabinet-makers, and it makes the most durable of all chairs; but this has been noted elsewhere. Many of the elm trees, when old, throw out large blisters, or overgrowths, knots, &c. which are striped and variegated in a most beautiful manner, resembling, and even superior to some of the fine Spanish mahogany, and is bought up at a great price by cabinet-makers, who veneer tables, &c. with it. The elm timber, the best kind of it, from the general demand, its answering so many purposes, will always meet with a ready market; but as it does not agree with every soil and situation, and from its roots requiring so much more room than any other tree in a plantation, therefore plantations of the elm alone would not be so profitably reared as some of the other trees, but its uses in hedge rows, and single trees, as ornaments, &c. are well known, and can be profitably raised in this way, and about the verges of plantations, &c.

Seasoning and Felling.—The elm is remarkable for keeping its natural sap for a length of time, both during the winter months, when growing, and after being cut down. I have known a large tree of elm sending out shoots from the bark after having been cut down and lying in the timber yard for nine years. The elm should always be cut down in the month of December; and for the sake of its seasoning and timber, this should be scrupulously attended to. The elm, like the Spanish chesnut, and the oak, particularly the Scotch, has two kinds of timber, red and white, commonly called the heart and sap wood. This sap, or white wood, is not so durable as the heart, and the white wood retaining the sap for such a long time that the elm in the ordinary way of seasoning cannot be put for work for a great number of years, or if made into work before being properly seasoned, it makes a bad job, and shortens its durability. There is no timber that would be so much improved in its quality as the timber of the elm by peeling the bark off, and allowing it to stand for six or eight months before cutting it down, by which the white or sap wood would be hardened to a consolidation with the heart. If it could be convenient for the proprietor to bark, and allow the elm to stand for eighteen months, it would be still better for the timber; and in this case it could be cut down and planked into its purposes immediately; and the timber when sawn into planks or boards, put up into a wood ree, (as observed with the ash), exposed to the weather for six months, which gives it a fine colour like mahogany, when to be used by the cabinet-makers. For this purpose the elm should always be barked in April or May, and allowed to stand as aforesaid. But it so often happens that the elm must be cut down with the bark, the next best method of preserving all the qualities of the timber, and bettering them if possible, is, immediately after being cut down, to take off the whole of the bark and dry it in the steam stove, if possible; if this cannot be got done, steam it with the hot lime, as directed in the Spanish chesnut and the oak, and when to be used in a whole piece, such as ship-keels, or carriage-naves, it may be used for those purposes in two or three months after, but when to be used in boards, or thin scantlings, or chairs, or other purposes by the cabinet-makers, it must not be sawn up for at least nine or twelve months, and after weather-beaten, as aforesaid; but when dried and seasoned in the steam stove, it may be sawn up immediately after. I have often seen the elm in the log, and also after being cut up into boards, buried into a stable dunghill; this I do not think has great effect in seasoning the timber in the log, unless it lies a long time, but when it lies a few months in the plank it gives it a high colouring, and resembling mahogany, and reddens the white or sap wood to nearly the same colour.

THE LIME.—*Its Nativity, Soil, Situation, Purposes, Value, and Seasoning.*

Nativity.—The lime most generally known in the three kingdoms is a native of England, yet it grows in all parts of Europe and in America. This is by no means a profitable forest tree; but its timber being useful for some particular purposes, and as it is a very ornamental and easy reared tree, we give it a place very briefly, only without enumerating its many and various kinds.

Soil.—The best soil for the lime is a good rich loamy earth, where there is depth and room for the roots to spread, but it will grow elsewhere. Too much moisture is an enemy to it, and so is excessive dryness. Where the soil is a cold clay, and apt to detain water a great while, the lime should not be planted, for the wet always chills, and frequently kills the roots. Where there is poor gravel on very stony land, it is not favourable for the lime; but in a gravel, with a good mixture of loamy earth, the lime will thrive well. This, particularly with regard to the soil of the lime, is the more needful to be observed, because its bulk depends upon it, and it is for want of a due regard to this that many of the limetrees does not arrive at that magnitude and maturity that they are required for as an ornamental tree. In sandy soils the leaves of the lime come out a fortnight sooner than in others, and in wet clayey and cold lands they fall two months before their time. This may be a mark for the planter whether the soil suits the tree; for the too great forwardness of the leaves is as bad a token as their too early decay. In some such soils the lime will live without flourishing, and those who have seen it only in such, will not know what may be its value. Whereas the lime in a favourable soil will grow to about 100 feet high, and to immense dimensions in girt; it has often measured fourteen and sixteen yards round the trunk, and perfectly sound.

Situation.—The lime will not thrive well, nor grow to a great size on the tops of hills, nor on high elevations, nor in dens, but loves a level situation best, rather a little raised as otherways. It is not only here and there a tree in a park or lawn, which is most beautiful, and grows to a large size, but they are remarkably beautiful in avenues, and will grow to a great size, although pressed the two ways, and that too with great regularity and evenness, so much so that one is apt to imagine their branches had been artificially clapped in avenues of this kind; they are remarkably ornamental, and stand transplanting at a large size, and polireding so well, that an avenue of large limetrees may be made all at once. The beauty and free growth of the lime have recommended it greatly for all such walks and avenues; and the fragrance of its flowers is a great consideration in its favour; but many are displeased with them because of the early decay of their leaves. It is one of the first trees that puts us in mind of the approach of winter; and in a disagreeable soil much sooner than many other trees. Its leaves will sometimes fall in the end of August, one month at least sooner than any other tree. This disagreeable circumstance, together with the dirt and litter such a number of leaves make, disgusts people very much, and has banished it from many pleasure grounds. But to these disadvantages it exeells most trees in two particulars; scarce any tree bears the fury of the winds better, or is less liable to ordinary accidents; and its timber keeps sound in growing to a great age.

Purposes and Value.—The lime timber is used by the carvers, and most of picture frames, &c. are made of it. It is also used for inlaying, and when used in its natural colour is as white as the holly; and in dying into the various colours for inlaying it takes in the dye much better than the holly. It is also used for dressing-tables, and keept in its white colour; and for poles for drying dyed silk and yearn upon, and when clean used for these purposes, is sold for 2s. 6d. per foot. It is also used in husbandry for the same purposes as the saugh, and sells at from 1s. 6d. to 1s. 10d. for that purpose. As we said before, although the lime is useful for the important purposes as aforesaid, it is by no means a profitable tree for planting and rearing in whole plantations as a forest tree solely for profit.

Seasoning and Felling.—The lime tree should always be cut in the month of December. But it would season much better to bark it standing, and allow it to stand as long as directed for the elm. But when the timber of the lime is to be used for its whiteness, it must be sawn up as soon as cut down, and kept always dry till seasoned, and in this case it is not easy to keep it from warping. When to be used for other purposes it may be dried in the stove, &c. in the log or whole piece, and this will keep it from warping.

THE SYCAMORE OR PLANE.—*Its Nativity, Soil, Situation, Purposes, Value, and Seasoning.*

Nativity.—The sycamore and plane are so much alike, particularly as to their timber, that we shall speak of them at the same time, as their name is often and generally synonymous. The only difference being as to the leaves and foliage. They are natives of the continent of Europe and America. They grow to a great size, live to a great age, and are truly a beautiful and ornamental tree, whether singled out in a grove or in a plantation; and is the earliest tree in blossom in spring of all the hardwood tribe.

Soil.—The natural soil of the plane is a rich but light mould, where there is some degree of moisture. It will grow on almost any soil if not too dry.

Situation.—To take a view of the situations that the planetree will grow, thrive, and become a large tree in, is truly astonishing, and may well create surprise. It will grow on the tops of the highest hills, lowest vallies, and almost within the sea mark, at least when exposed to the lashing of the sea spray. See this wonderfully exemplified in the case of these planes on island M'Kasken in the western ocean near the great gulf of Corryvrecken, (as mentioned in my Miscellaneous Reports, &c. p. 49.) The plane affords most excellent shelter about a mansion, a garden, or even other trees; besides the largeness of their leaves and foliage, they send out large branches or arms, which affords shelter in winter. In all situations too they will grow from being cut over as a coppice, and are far from being unprofitable even in this respect, as will be seen anon.

Purposes and Value.—The planetree is a most valuable timber tree, when allowed to grow to a great size, so as to be fit for machinery purposes, as is elsewhere shown in this book. Its timber is also the only kind that will last, or will stand in making wooden bowls, dishes of various kinds, trenchers, and cheesewalls for making cheese into, and for barrel ends; and, for these purposes, sells at 2s. per foot. It is for these purposes that we are here to consider it as a profitable tree to rear up as a crop of timber. Whole plantations of the plane to be reared up as large old timber trees, notwithstanding the great price for their large timber, is not so profitable as the other kinds, say the ash, Spanish chesnut, and oak. As the plane grows natural from the old cut root or stool, it may, with advantage and profit, be reared as a coppice on spots and in places where the other kinds would not grow. As the plane then can be reared as a coppice, and at twenty-five years old it will be ample size for cutting up into the purposes aforesaid, we shall suppose 600 stools or rather trees to be planted on an acre, these are to be cut over at the age of twenty years. From the plant at this age the crop will only be worth L.15 per acre; these 600 stools or roots are to be dressed up and properly thinned to three shoots from each stool, as before advised in thinning coppice stools. Here we have three shoots from each of the 600 stools, which is 1800 trees on the acre, to be reared up to twenty-five years old. I may here observe by the way, that the plane is required perfectly straight and clean, so that a great many more of them can be trained up than of oaks, &c. on the same space of ground. Now as the plane grows amazingly fast from the natural stool, at twenty-five years old each of their shoots will average at the very least three feet of timber, which is 5400 feet, at 2s. is L.540 per acre for twenty-five years. This is a great sum, and is much more in many cases than the oak coppice; but this is owing to the number of planes that can be reared on an acre to that age, over what can be reared of oak, as the planes must be pruned up straight, &c. All those who are in the least acquainted, or who has paid the least attention to the growth of the plane from the old stool, will at once say that I am rather under than above the true estimate of their growth, as a shoot of planetree twenty-five years old is often seen to make five and six feet of timber. Let it be carefully observed, that we are all the while talking of situations where the oak cannot be reared to advantage. But supposing the situation to admit of it, there should be always 200 shoots out of the 1800 to be reared up to maturity as large valuable timber trees. Could not (I would now beg leave submissively to ask) a young proprietor do much good to himself by even planting and rearing a crop of planetrees, which are so easily reared, L.540 per acre for every acre in twenty-five years, and after the first planting for time immemorial, without either seed or labour.

Seasoning and Felling. The proper time for cutting down the planetree for the good of the timber, is the month of December; this should be attended to when the timber is for any particular purpose, but for the smaller timber, say the coppice for the purposes aforesaid, it may be cut any time. When the planetree is to be used in a large log or piece, such as a callender bowl, &c. it should be put into the steam stove if possible, and this will keep it from throwing or twisting; when this cannot be done, it should be steamed with the hot lime, as in the oak, &c. when to be used as other purposes in boards, &c. it should be seasoned as the ash. When the planetree timber is to be used for any purpose because of its whiteness, as is often the case in making dressing-tables from it, and such like, it must then be cut up in a green state, that is, with the natural sap in it, and seasoned as the ash, put into the shade as soon as sawn, and kept from the rain always dry, but where the wind and drought will pass through it freely.

THE POPLAR. *Its Nativity, Soil, Situation, Purposes, Value, and Seasoning.*

Nativity.—There is said to be six kinds of poplars, all natives of Flanders and North America.

There are three or four kinds in this country, but there are only two kinds worthy of the planter's particular attention as profitable trees. These are commonly distinguished by the name of the white, and black or red poplar, and the trees distinguish themselves from each other, as the white poplar is very white in the timber all through like the lime-tree, and the other is red or blackish in the heart, with a white ring of from one to three inches in breadth on the outside, resembling the Spanish chesnut and elm; but as these will invariably grow on the same soil and situation, and nearly equally quick, and their timber being of equal value, we shall consider them as the same.

Soil and Situation. The best soil for the poplar is a rich, moist, flat, and low ground, where there is plenty of moisture. They will grow to great advantage where no other tree will thrive, and in many places where no other tree will grow; and in this case it is a most valuable and profitable tree to plant on many estates; indeed it is most surprising that it is so little planted. Nothing is more wanted in this country than a general knowledge of timber trees, which would at once encourage the taste for planting and make it successful. Few turn their thoughts to it, and of those who do so, the most seem not to know that there are above three or four timber trees in the kingdom worthy of planting; and these, say they, are the oak, ash, elm, and the beech; and if one or other of these kinds will not do, the ground is at once pronounced unfit for planting. It is true not one of these will grow on the rotten soil of a fen; but the poplar will grow there, and will not only be beautiful, but will yield the owners a vast profit, as I will very soon show them; and this on grounds that they never before reaped any thing from. There is a still farther consideration which should induce them to plant it, which is the quickness of its growth, in which it exceeds almost all other trees. The great and universal objection to planting, is the length of time required to reap its benefits. People are unwilling to labour for posterity; but the quickness of the growth, and the great beauty of this tree, are sufficient recommendations to plant the poplar, to all those who want either quick pleasure or quick profit, as thirty years brings this tree to maturity, and twenty years to be valuable timber, and ten years when to be sold for poles, &c. brings it to be profitable; but more of this anon; so that a man who plants the poplar, plants for himself and may reap the benefit of it. To give only one example amongst many of the quickness of its growth, John M'Allam, still in life, forester to J. Campbell, Esq. of Stonefield, after he was married, and had a family above thirty years of age, planted on Mr. Campbell's estate of Levenside, Dumbartonshire, a number of poplars by the side of a ditch, without taking up land of any use, and I measured, in company with John M'Allam, a great many of these poplar trees, (particularly those near the mill of Balloch) in July 1827, the trees were then twenty-nine and thirty years old, and many of them were upwards of sixty solid feet of timber, and most beautiful tall trees; one of them girthed seven feet nine inches at the height of six feet. Trees springing up to such a size in one's own day, would gladden the heart of any proprietor, and that too on boggy and wet places, where nothing else would grow.

Purposes and Value.—The timber of this tree may be applied to all the purposes that the saugh can be applied to; and from the straightness and tallness of its growth, it may very fitly and very profitably be applied in house work, wherein fir is more generally used, such as roofing, joisting, &c. and the white poplar even in flooring; and it will be found equally durable as the fir timber. Of all the kinds of timber that grow, none answers the purpose of making bellows boards so well, as it is not so apt to warp and twist as many others. I have also used the timber of the white poplar in finishing the rooms of ordinary good houses for window frames and shutters, &c. and when left in its natural white colour, it looks well. As great quantities of it are also used for almost every country purpose that foreign fir is used for, it will sell every where at 2s. per foot, and in some places I have known 2s. 6d. paid for it when of large size. It will attain a size sufficient at the age of twenty years to bring 2s. per foot. From what we have already said, the poplars will grow to a great size in thirty years; but I have seen poplars many a time, where the soil and situation answers them, with twenty and twenty-five solid feet of timber in eighteen and twenty years. Now, it is a well known and well established fact, that the poplar grows up very tall and straight, making almost one straight stem or shoot of a gradual taper towards the top, and seldom or never sends out branches of any consequence, for this reason, like the larch fir, they can be reared very close on the ground. The trees I have already mentioned on the estate of Levenside, were growing at only seven or eight feet distant from each other, and were planted at ten feet asunder at first. A Scotch acre of land will carry, at this rate, upwards of five hundred trees; now we shall say five hundred poplars on an acre at twenty years old, at an ordinary growth, will average only twenty feet each tree, which is 10,000 feet at 2s. per foot, is L.1000 for a crop on each acre, at twenty years. As the poplar, like many other trees, will grow and increase much more rapidly to the timber, when the soil suits and the trees are thriving, after the first twenty years than before it, so that at ten years more, say at the age of thirty, we may fairly reckon them to average at least forty feet a tree, which is 20,000 feet at 2s. per foot, is L.2000 per acre in thirty years. Now this is even far below what these trees will grow to on soils and situations fitting them; the trees at Levenside before mentioned averaged about sixty feet. Now we are only supposing ours to be forty feet each, this is making a great allowance, and very far under-rating what it is not only possible to rear, but what they actually will do, and still we have in every twenty years for a crop on every acre L.1000 Sterling, and in every thirty years a crop on every acre worth the enormous sum of L.2000 Sterling. As these poplars can be used in house-building, in place of foreign fir, there is always plenty of demand for them, so that we shall suppose a proprietor plants twenty acres with poplar, he cuts regularly one acre every year, (which he can do without any expense whatever, as they grow from the old stool, from cuttings, or any way, nothing more easy to rear,) from which he receives L.1000 annually, but supposing he plants thirty acres, which will be more profitable, and at this age the timber is fit for all and every purpose, he cuts one acre yearly, and he receives the enormous sum of L.2000 every year for the rent of thirty acres of land, and he receives this L.2000 annually for land that otherwise would not pay him perhaps L.10 or L.15. Where is the avaricious proprietor that would not be satisfied with such a return as this, and that too, without any risk, besides the infinite pleasure and gratification he must feel on seeing these perfections of nature's beauties arising in all their splendour to such a magnitude in so short a time, so that every morning, when he walks out in the shooting, or summer season, he can discern and mark their progress, growing with vigour when he is sleeping, when he is in the church, or in the court, when he is at home or abroad, in the house or by the way. Is it not surprisingly strange when I tell it as a fact, that I know and could name estates where there is some hundreds of acres, and the whole rental under L.2000 annually, some under L.1000, and yet there is thirty acres of land that would pay L.2000 annually, and not take as much ground as would otherwise give twenty shillings of rent. It is really not credible, my readers will say, that there is such a proprietor so blind to his own interest as to refuse to make L.2000 annually from thirty acres of his estate, when the whole property, some hundreds of acres, is not paying him L.700, and even that liable to risings and fallings, and constant risk of payments, &c. yet strange as it may appear, I can with the finger of discernment clearly point out one, two, three, and more cases, and say, as Nathan said to David, "Thou art the man." If this incontrovertible fact, (and I am ready to prove it, were proofs wanting,) will not remove the scale from their eyes, I may and will write, O foolish and incorrigible generation; and as an arborist never lift my pen more.*

Seasoning and Felling—The best season for felling the poplar is the month of December. For the good of the timber, as it hardens and toughens it very considerably, it should be barked in the month of April, and allowed to stand till December, when it would be fit for cutting up into the purposes it is to be used for. In this case, if care is taken to notch the tree all round, close to the surface of the gound, with an axe or saw, and not loosen or break the bark of the root, the young growth would be preserved. I am well aware that it is not agreeable to the eye to see the trees striped naked, and standing bare, "like so many Marsyoses or Saint Bartholomew's, amongst their more fortunate neighbours," as Sir Walter Scott has it; but still it is of great use to the seasoning and hardening of the timber, and should be always done, whenever it can be conveniently done without offending the eye. The white poplar needs very little seasoning, as it is a wood that does not warp or twist like the lime, or most other soft woods, neither does it cling or shrink so much as other wood, although used very green. The black needs a little more seasoning than the white, but neither of them nearly so much as other woods. Both kinds of the poplar are very good for outer-doors, or any outwork, as it stands the wet and dry without shrinking, much better than other woods. All kinds of timber, season it as you will, will swell and shrink with the different heats and cold, and moisture, and dryness of the air; but no kind will come and go with the weather, so little as the poplar, and it will do with less seasoning than any other kind.

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* There is a most wonderful tree of this kind of poplar on the estate of Springwood Park, the property of Sir John J. Scott Douglas, Bart. in Roxburghshire. It is the largest of the kind in the three kingdoms, its trunk girths nearly twenty feet at the smallest place, and contains nearly 800 solid feet of timber, measured down to six inches. This dandled darling of nature's children, overshades the public road a little above Kelso bridge. It is truly a lofty, noble, and magnificent tree, not yet a century old, healthy, and still growing. Every passing stranger admires it.

Many authors have stated the poplar to arrive at full maturity at the age of twenty years, and should then be cut down; but I have, for the most part, in the course of my experience found, that the poplar grows far more to the increase in timber, after the age of eighteen and twenty, than before it, as I have regularly measured them, and found that they grow more to the thickness of the tree in one year after they have attained their height (which, by the way, they generally do before or about the age of twenty) than they do in three years before. I should therefore suppose the timber at its best at thirty years, at least I have always found it to be so in Scotland. The poplar, it is well known, is also easily propagated, and may be raised by layers, or cuttings, &c. An English author informs us, he has seen them from cuttings, grow upwards of thirty feet high in six years, and thicker than a child's waist, and shooting sometimes ten and twelve feet in a few years. Some have recommended the aspen tree, but I have never seen it grow equal to the poplar, therefore I do not consider it as a profitable forest tree. The ease and speed with which a poplar tree, or a plantation of poplar trees can be reared, together with the profit from them, holds out every inducement to their being an object worth a proprietor's particular attention. Besides all this, they will grow and be very beautiful in avenues, and about the sides of private walks, and as a pollard tree, and they can at once be reared up as a screen about any bog, mire, or any spot whatever, that is disagreeable to the eye, and that a gentleman wants to cover from the view of his pleasure grounds, &c. Taking the poplar in all its bearings, it is wonderful its propagation is not more attended to.

SECTION XXI.

THE SAUGH OR WILLOW TREE.

Its Nativity, Soil, Situation, Purposes, Value, and Seasoning.

Nativity.—There are a very great many kinds of saugh, or willow tree, and Holland is said to be the native place, and great nursery of them. It, however, has been a well known tree in England, and some parts of Scotland, for time immemorial. It is, like the poplar, a very easy propagated tree, as it may be planted from cuttings, and indeed in any way that the poplar can be raised, so can the saugh. We shall, in the saugh, as in the case of the poplar, confine ourselves to two kinds only, and the timber of these are distinguished by the well known names of the white and red saugh, the one being all white wood, and the other having a red heart with a ring of white wood on the outside like the elm, and these are the only two kinds that can be profitably raised as timber trees.

Soil and Situation.—To attempt a description of the soil and situation of the saugh here would be superfluous, as the reader need only look back to the poplar, and take that for the saugh, with this difference, that the red saugh will grow and thrive on a soil with less mixture than the poplar, and even in a more exposed situation, as we often found the saughs growing on the sides of hills, &c. But the most natural and best soil and situation for the saugh is a damp rich earth, near waters, and in flat low grounds, tending to clay, and can with great advantage and propriety be reared about the sides of coarse land ditches, and by the sides of running streams, where nothing else can be planted or grow; in all such places they may be profitably planted, as they will grow without being inclosed, as cattle are not so fond of cropping or eating them as they are of most others.

Purposes and Value.—The saugh will answer all the purposes that the poplar will, except that it generally grows more crooked, and is not so fit for house purposes. The red saugh answers well, and has been often used in small ship-building, such as floor timbers and the like, where it is always damp or under water. It makes excellent flooring, both as timbers and planks for vessels employed in driving lime-stone, iron, stone, coals and the like, as from its tough nature it is not so apt to split as most other timbers; and the saugh will last much longer than other wood for this purpose. I once saw a saugh floor timber that had been taken out of an old sloop belonging to Mr. Adamson, Kincardine, after it had been twenty-two years in the vessel, with some of the bark fresh on it. After it had been some time on the shore it began to grow and send out young shoots. I cut off one with a piece of the bark and timber, took it in my pocket, and planted it, and it is now a large tree. The saugh tree too is generally used about founderies, coal and lime works, &c. for cutting into boards for cleading waggons, barrows, coal-buckets for bringing up the coal from the pit-bottom, &c. And for a great many like purposes the saugh is in general use. From its nature, as well as from the places where it is generally planted, about the sides of ditches, it generally grows crooked, and is often used in making mill-wheels, &c., for which it answers well. When used for any of the particular purposes we have mentioned, it sells for 2s. 6d. per foot, but when in common use its average price may be reckoned at 2s. per foot. It is necessary that I inform the planter here, that in planting one or more acres of the saugh tree, that it requires more room than the poplar; this is particularly the case with the red saugh, as it generally makes larger branches. The white saugh will, by a little attention, train up to a straight tall stem, and the same number of trees of white saugh may be reared on an acre as that of the poplar. In rearing the red saugh, 400 trees will be a sufficiency on an acre; but when we consider that the red saugh commonly sells at sixpence per foot higher than the white or poplar, this will make up the difference as to quantity of timber, and the more so, that the value of an acre of the poplars and saugh will be the same; and a planter ought to consider the place of the country he resides in, and plant the kinds that will be in most demand, as the same kind of soil and situation as before mentioned will suit all the kinds. With this difference, I have always found the saughs do better than the poplars in single rows about ditches. I know the late proprietor, William Murray, Esq. of Polmase estate in Stirlingshire, drew, in the course of three or four years, fully L.1000 Sterling for saugh trees that grew on the side of Bannockburn Burn, from what is called the Crook Bridge to the farm of Johnston, not above one English mile in length, and a good proportion of the trees still standing, which trees were all planted by himself or his tenants after he came to the estate. At the first cutting of these trees, the oldest was not above thirty-two years, some of them sold for six guineas a tree, and this on land that could not be turned to any other purpose; as it was five or six times every year, and sometimes oftener, overflowed with water.

These saughs come like the poplar to be of value in twenty years, and in thirty years may be said to be at maturity. I had occasion in my miscellaneous reports to notice two saugh trees which were stuck in from a small twig or cut, by the present gardener at Duntroon Castle, only twenty-five years old where I measured them, containing fifty-eight solid feet of timber of excellent quality, and one of them a fine crook or bend, which would do for a particular purpose. We may reckon them at 2s. 6d. per foot or L.7, 5s., say L.3, 12s. 6d. each tree. Now, suppose one acre of 400 trees growing at this rate would be L.1,450 Sterling for the crop of each acre for twenty-five years. This is an immense increase for so short a time, but it is what would be readily realised on land adapted for the purpose. I must here be allowed to observe, that the two saugh trees as above, are growing in a very exposed situation, and rather a dry soil. I beg again to refer my readers to the planting and cutting of the poplars, and to do the same with the saughs, and there will be the same increase, that is, plant twenty acres of saughs, and at the age of twenty, cut one acre every year, from which there will be L.1000 of produce; or plant thirty acres, and cut an acre every thirty years, and you will have L.2000 of annual produce for ever after. I may here observe, to bring it into the regular cuttings, say there is thirty acres planted, begin to cut the first acre at fifteen years old, and by cutting one acre yearly, you will finish at forty-five years old, which will make up for the deficiency of the early cuttings, and then you begin at the first cut acres, which is thirty years old, and cut one acre for ever after at thirty years old, for which you will have L.2000 or upwards, annual rent—See the poplar. It is not to be understood that I would confine the proprietor or planter to twenty or thirty acres alone; he may have sixty or one hundred acres, less or more, but the more the better, and cut less or more acres each year, as he has land adapted for the purpose. I have been told, by some English planters, that an acre of ground, properly planted with saugh, will, at eleven years growth, yield a hundred loads of wood. If such is the case for eleven years, it should do for more than I have stated in twenty or thirty years.

Seasoning.—As the same method must be attended to in cutting down and seasoning the saugh that is laid down for the poplar, it would be of no use to resume it here. The only difference is, that the saugh, especially the red, requires longer time than the poplar, without which it is more apt to warp and shrink than the poplar is. The saugh is the best wood yet known for the boards of the paddles of the wheels used in the steam vessels.

I stand pledged at the beginning of this article only to take particular notice of such trees as could be reared with advantage, and by the raising of which the planter would have the most profit; and thus far I have finished those of the hard wood tribe. Although there are a few hard wood trees still that should not be lost sight of in planting, when ornament is to be kept in view, such as the walnut tree, the cherry or gean tree, the maple, the hornbeam, and the holly, all of which make good timber trees, and the timber of the walnut and the holly brings a high price, as does also the cherry tree. But none of these can be profitably raised as a forest tree, and are therefore not fit for my purpose.

I beg here also to observe, that although the profits to be derived from planting all the different kinds of trees, as before particularly described, is certain, and a few proofs and stubborn facts have been mentioned as we went along, amongst many more that I might have given of it, nor am I aware, that I have in one single instance exaggerated, yet if there should be some little failure, there will still be ample increase, yea enormous profits; enough to satisfy the most avaricious, and that from the very best land no profits, any way equal to it, can be obtained by any other kind of cropping. I would not have a proprietor circumscribe his plantations, when he plants solely for profit; too much to the very worst of his land. Let us hear Sir Walter Scott on this subject:—"The planter," says Sir Walter, "must not, as we have often seen, vainly attempt to endeavour to exclude from his proposed plantation all but the very worst of the ground. Whenever such paltry savings have been attempted, the consequences have been very undesirable in all respects. In the first place, the expense of fencing is greatly increased, for in order to form these pinched and restricted plantations, a great many turnings, and involutions, and independent fences must be made, which become totally unnecessary when the woodland is formed on an ample and liberal scale. In the second place, this parsimonious system leads to circumstances contrary to Christian charity; for the eyes of every human being that looks on plantations so formed, feeling hurt, as if a handful of sand were flung into them, the sufferers are too apt to vent their resentment in the worst of wishes against the devisers and perpetrators of such enormities. It is therefore perfectly necessary for the rightly obtaining of the desired end, when the interests of the present proprietor and that of his posterity is so much concerned, and so much connected, to lay off all such plantations solely for profit, both for the present generation and the generations to come, with a bold, and not with a timid hand, and not to be over parsimonious in the first laying off of his plantations, lest he repent it when too late; like the school-boy who despised his learning, ay and until he came to experience the want of it; or like the man who refused to take hold of the rope flung to him, when drowning, but laid hold of the white foam of the water and sunk unregretted."

SECTION XXII.

AVERAGE PRICES OF HARD WOOD.

I SHALL now enter upon what may be considered as the average prices of hard wood for the years 1817, 1818, 1819, and the spring of 1820, up to 1824. I am now enabled to add in this edition the average price up to 1828, at the ports of Leith, Glasgow, Greenock, Perth, Dundee, and Aberdeen. I am also enabled to include the prices up to 1828 at the ports of London, Liverpool, Dublin and Belfast, taking whole cargoes, from six inches in the side of the square, line, or girth measure, and supposing the average square girth of every cargo and kind not less than ten inches, and the quality good. Here let the reader always keep in view, that the prices mentioned are for the solid or cubic foot of round timber, line measure, and one-fourth of the girth taken for the side of the square, after deducting an allowance for bark.

This observation is the more necessary, as all English oak, or other hard wood trees brought to any of the above ports, are all sided or squared a little, and sold by the calliper measure, taking the diameter of the piece for the square, which makes a very considerable difference in the measure, and of course in the price; but in this case we proceed by the line measure, according to Hopus, as the standard measure of all kinds of timber, as I have done all along.

Average Prices at the Port

OF LEITH.

	Per foot.			When particularly good.		In 1828.				
	s.	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*
Oak, . . .	3	6	and	4	6	3	0	and	4	0
Ash, . . .	3	0		3	6	2	6		3	0
Elm, . .	3	0		4	0	2	9		4	0
Planetree, . .	2	9		3	3	2	6		4	0
Beech, . .	2	0		2	4	1	10		2	6

	Per foot.		When particularly good.		In 1828.			
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Spanish chesnut,	3	0	4	0	None imported.			
Walnut,	3	6	4	6	3	0	3	6
Cherry or gean tree,	2	0	2	6	1	10	2	6
Saugh,	2	0	2	9	2	0	3	0
Birch and alder, chiefly for stores,	1	6	—		1	3	1	6
Hornbeam,	2	3	—		2	0	—	
Laburnum,	2	3	—		2	0	2	6

AT GLASGOW.

Oak,*	4	6	5	0	4	0	4	6
Ash,	3	6	4	6	3	0	4	0
Elm,	3	3	4	6	3	0	3	6
Planetree,	3	6	4	6	3	9	5	0
Beech,	2	0	2	9	1	10	2	6
Spanish chesnut,	3	0	3	6	2	6	3	0
Walnut,	3	3	4	0	2	6	3	0
Cherry or gean,	2	0	2	9	1	10	2	3
Saugh,	2	8	3	3	2	3	3	0
Birch,	1	0	2	0	1	3	2	0
Alder,	1	6	—		1	6	—	
Hornbeam,	2	6	—		1	9	2	0
Laburnum,	2	6	—		2	6	3	0

AT GREENOCK.

Oak,	3	6	4	0	3	0	3	6
Ash,	3	4	3	9	3	0	3	3
Elm,	3	2	3	6	3	0	3	3
Planetree,	3	3	3	9	3	0	3	6
Beech,	2	2	2	6	1	10	4	0

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* Let it be kept in view, that there is scarcely any oak sent hither for ship-building, but chiefly for machinery; and, consequently, it sells higher when suitable for that purpose.

	Per foot.		When particularly good.		1828.			
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Spanish chesnut,	3	0	4	0	None imported.			
Saugh,	2	4	2	6	2	0	3	0
Birch and alder,	1	8	——		1	3	1	6
AT PERTH.								
Oak,	2	0	3	0	2	2	3	3
Ash and elm,	2	9	3	0	2	3	2	9
Planetree,	2	6	3	0	2	0	2	6
Spanish chesnut,	2	6	3	0	2	0	3	0
Beech,	1	10	2	0	1	6	2	0
Gean,	2	0	——		——		——	
Birch and alder,	1	0	——		1	0	1	6
AT DUNDEE.								
Oak,	3	6	4	0	3	0	4	0
Ash,	3	0	3	6	3	0	3	3
Elm,	2	9	3	6	2	6	3	6
Planetree,	2	6	3	0	2	0	2	6
Beech,	1	10	2	3	1	9	2	2
Spanish chesnut,	2	6	3	0	——		——	
Saugh,	2	4	2	6	——		——	
Birch and alder,	1	2½	——		1	2	1	6
AT ABERDEEN.								
Oak,	3	6	4	0	3	0	3	6
Ash,	3	9	4	0	3	0	3	9
Elm,	3	6	4	6	3	0	4	0
Beech,	3	0	3	6	2	6	3	0
Planetree,	3	3	3	6	2	6	3	0
Beech and alder,	2	0	——		1	6	2	0
Cherry or gean,	2	6	——		2	0	2	0

Average prices of three years at the Ports of London, &c. in 1828.

LONDON.

	Per foot.		When particularly good.	
	s.	d.	s.	d.
Oak,	3	6	6	0
Ash,	3	3	4	0
Elm,	3	6	5	0
Planetree,	3	0	4	6
Beech,	2	9	3	3
Spanish chesnut,	3	6	4	2
Walnut,	3	6	4	6
Cherry or gean,	2	0	2	6
Saugh,	2	6	2	9
Birch and alder,	1	6	2	3
Laburnum,	2	6	3	0

AT LIVERPOOL.

Oak,	3	3	6	0
Ash,	3	0	3	6
Elm,	3	0	5	0
Planetree,	2	6	3	6
Beech,	3	0	4	0
Spanish chesnut,	3	0	4	0
Walnut,	3	0	3	9
Cherry or gean,	—		—	
Saugh,	2	3	3	6
Birch, and alder,	1	6	2	0
Laburnum,	2	2	3	6

AT DUBLIN.

Oak,	3	0	3	6
Ash,	2	6	3	0
Elm,	2	0	4	0
Plantree,	2	6	3	0

	s.	d.	s.	d.
Beech,	2	3	3	0
Spanish chesnut,	3	0	4	0
Walnut,	3	0	3	6
Cherry gean,	2	0	2	2
Saugh,	2	6	3	0
Birch, alder, and small beech,	1	6	2	0
Laburnum, used for ship-blocks,	2	0	3	6
Hollay, ditto, ditto,	2	0	3	0

AT BELFAST.

	s.	d.	s.	d.
Oak,	3	0	3	6
Ash,	2	3	3	3
Elm,	2	6	3	9
Planetree,	2	6	3	6
Beech,	2	2	2	10
Spanish chesnut, none imported,				
Walnut,	3	3	3	1
Cherry or gean,	2	2	2	6
Saugh,	2	2	2	3
Birch, alder, and other small hard wood, chiefly for staves,	1	6	2	2
Hollay and laburnum, used for ship-blocks, &c.	2	6	3	2

These are the general prices when bought in cargoes or quantities, confined to seven inches on the side of the square and upwards. The particular elm, when the prices are so very high, are chiefly bought up for the use of ship-building, and must be understood to be cargoes of timber, such as will suit that purpose. It will be observed that beech is very high at Liverpool, Dublin, and Belfast.

This is owing to the immense number of piles, which are all beech, used in the new harbours making at Liverpool, a great part of which is exported from Ireland. When I was in Ireland in 1826, I sold a large quantity of beech for piles from a nobleman's estate there, to the New Dock Company at Liverpool, at 3s. per foot, none of it above ten inches square on the side at mid length. The reader will be pleased to observe, that on comparing the prices at the different sea-port towns in England, Scotland, and Ireland, with those stated in the system of profitable planting of the different kinds of trees, he will there see that I have made ample allowance for carriage, &c. from almost any estate within twenty miles of where it can be shipped, so that a proprietor, whose lands have a local situation to the sea, will realize ten per cent. more than I have estimated it at, so that the profits are far, very far, from being over-rated.

The average of all kinds of timber was much higher, at least a shilling per foot, at all these places, during the late war, compared with what they are now. The prices were higher in 1824 than they are now, still they are much better than they were for a number of years after the peace; and if trade were reviving they would be still higher.

SECTION XXIII.

THE VALUE AND PURPOSES TO WHICH SCOTCH FIR TIMBER MAY BE APPLIED.

WERE the common Scotch fir, which is so congenial to the soil and climate of this country, and of the three kingdoms, I may say, permitted to arrive at the same age with foreign timber of the same kind, it would prove in every respect equally valuable. Were the Scotch fir allowed to stand on the ground for a hundred years or thereby, it would be equally durable, and fit for the same purposes as Norway or Memel fir; which I have learned from experience. Allow me to give the reader a single instance, which I trust will justify the above remark.

In the year 1795, at the request of the owner of a house in Bannockburn, Stirlingshire, I made some window sashes for his house from the common Scotch fir, being the wood of some old trees which I had cut from the estate of Auchenbowie, in the same county. For the same house, and at the same period, I made some sashes from the best Gottenburgh deal then imported. These sashes were put into oak cases or frames, where they at present stand, (1824,) being twenty-eight years of age, and are still standing without any material difference now, in 1828. The Scotch fir sashes looked as well at the time they were put in, and do to this day, and appear to be equally durable, as those made from the foreign deal. There was also made in the same year, and from the same Scottish fir timber, several bound doors, which can be seen at this day without any paint, equally as fresh looking as when made. I was told the age of those trees did not exceed eighty years. The root cuts of them were remarkably clean and free from knots or blemishes, for twelve and some of them eighteen feet from the root, excepting in a few cases, where the branches had been allowed to rot and fall off, which, in some instances, left a loose knot or a hole, which made a very considerable blemish in the board after being cut up. These trees had never been known to be pruned. It is therefore absolutely necessary, and most essential to the value of common Scotch fir trees, that, as soon as the branches begin to die, or to show symptoms of decay, they be pruned off close to the bole or main body of the tree, for if left to root off it always makes a blemish in the timber when cut up into boards, and often times by admitting of wet into the bole of the tree puts a stop to its growth, and finally kills it. It is perfectly evident, that the fine fir logs imported from Memel are never pruned, and that the branches are allowed to rot off them, since it is a fact well known to the workers of Memel timber, that when a coarse knotty log is cut up, if it does not immediately show a hole in the board, the knots are always ready to fall out on the least pressure when among the hands of the workman, and however cautiously he makes the plane go over them, they are apt to get loose, and must be put in with glue, and are never firm.

In the summer of 1818, I was asked to accompany a gentleman of Dundee on board a vessel direct from Norway, loaded with fir battens, which he wished to purchase. Accordingly I went on board, and, after turning over a great many that were on deck, I found they were extremely coarse, indeed more so than any of the kind I had ever seen before. I told the master of the vessel, who was also the merchant, that they were really as coarse as our Scotch fir; and I asked him the reason of their being so knotty, but he at this time declined to give me any reason; and the gentleman whom I had accompanied declining to buy them, we left the vessel. After we had got a considerable way up the quay from the vessel, the Norwegian captain followed, gave me a tap on the shoulder, and said he would wish to see me in the afternoon. I then began to suspect that the battens had come from some port in the north of Scotland, and, to ascertain the fact, I was anxious to have a conversation with him. Accordingly I attended at the time, and entered into a conversation with the man, whom I found to be very intelligent. Before he answered me any question, he asked me what line of business I was in? I told him I was a wood-cutter. "That," said the Norwegian, "was my father's trade, and likewise my own in the early part of my life." I now considered myself as very fortunate in having fallen in with one who could give me some information as to the woods in Norway, which are so much superior in quality to our Scotch fir woods.

In the first place, I inquired as to his battens. I am afraid, said he, you will hurt the sale of them. I assured him I would not, and told him I only wanted a little information as to how they managed their growing woods in Norway, and that if there was any thing new or very beneficial to be learned as to the nursing up of woods in Norway, I would go out a little and try to learn it. He smiled, and said that I would in that case be disappointed, as they had no way of managing the wood in Norway but cutting, squaring, and sawing, &c. As to the battens you saw on board, and which I know are not good, I shall explain. I have a brother in a sea-port in Norway, who is a merchant; and he and I are in company: this brig is our own; and while I sail her he stays at home, and makes bargains of wood, bark, or any thing he can buy up. It is my business to take them to England or Scotland and sell them, and take back goods for them. My brother bought these battens from a man who had purchased a large quantity of wood that grew in such a place that it was hardly possible to get it out. The wood was but young, only between thirty and forty years old, and it was very thin upon the ground, and was branched down to the very root; this made the battens so very coarse and knotty; and, continued he, my brother bought them at a very low price, as no other person would take them. I here remarked to him, that as these fir trees were so very coarse and knotty when young, how came it to pass that I saw a great many small spars brought from Norway, some of which he had on the deck of the vessel, from twenty to thirty feet long, very small, and perfectly straight, and scarcely a knot to be seen on them from end to end? I also asked how it happened that boat-oars were made from small Norway trees; and of these spars and oars I had seen great numbers come from Norway. Hold, hold! says the Norwegian, these spars and oars are not got amongst the young woods at all, but grow among the largest and oldest of our woods. These, says he, are all plants, (which we call seedlings,) and are always to be found where the wood is closest, and very often grow close by the side of a large tree.* They grow very tall and small, and there is no room for the growth of branches; and some of these may be of great age although small. I then took up a spar, and showed him it was all white wood; I took up another, and showed him it was all red wood; and I also showed him there was a great difference in the barks of these two spars, and said I conceived them to be two different species of fir trees, and that both of these were a different kind of tree from what the battens were cut from. He said the white wood spar was a different kind of fir tree, but the other spar was the same kind with the battens. I could not help differing from him on this point, as I was certain the battens were cut from what we call our common Scotch fir. I then asked him if he ever had been in any of our woods in Scotland? He said, never. I then asked him if he thought he could tell me, if I were to carry him to a plantation in the neighbourhood, if the species of trees were the same as in Norway? He said he could do so with perfect ease. As I was extremely anxious to know this, I told him I would take it exceedingly kind of him, if next day he would accompany me a few miles into the country, when I could show him all the different species of fir, and have his opinion. The obliging Norwegian instantly agreed, and we set off next morning by seven o'clock for the estate of Fotheringham, about 11 miles north of Dundee, where I was at the time employed in cutting oak wood. Here I had an opportunity of showing him all the different sorts of fir wood trees which are reared in this country. From him I found, to my entire satisfaction, that the best kind of fir wood in Norway is of the same species as our common Scotch fir. One of his spars was larch, yet he allowed it differed a little from ours. The other spar was the same as our spruce fir, which, he says, grows in vast abundance in Norway, and answers to their white wood, or pine fir, which they export hither. I then asked him if ever they pruned any of their fir woods? He smiled, and said, " Never, that would be impossible, from their extent;" but he added, " that they sometimes thinned them, but even that was not done to any great extent." I had some conversation with him respecting oak bark and barking; but this will come under another head. From all this, and my own experience, I am of opinion that fir timber could be reared in this country that might in time supply all our demand, both as to quantity and quality, equal to any which is imported.

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* This is often to be met with in fir plantations in Scotland; a seedling or sapling from the root spring up by the side of its parent tree to a great height, and of equal growth from the root to the top, and not thicker than a person's arm.

I requested of my Norwegian friend to bring with him, the next time he came to Scotland, a branch, with some of the cones on it, from all the different species of fir trees he could procure in his country, and then I would be a better judge; which he readily agreed to do: but I have never as yet heard any thing more of him; yet I do not doubt that he will fulfil his promise.

The average prices of all kinds of fir which grow in Scotland, with the exception of the larch, which is considered the most valuable, and the Weymouth pine, which is considered the least valuable. When sent to the ports of Leith, Glasgow, &c. if fit for roofing, or for cutting into boards for house carpenters, it has been 1s. 6d. to 2s. per foot, for the last three years, line measure, and about the same price when sent to any of the coal or lime works, where great quantities of that kind of wood are used. A great number of small young fir trees are used about coal works for what is called pit wood, and when sent to Sunderland or Newcastle, it sells at 7s. 6d. or any part in Scotland where it is used, at 6s. 6d. per hundred lineal or running feet, which must stand four inches diameter at the small end. As the Scotch fir, nor indeed any of the black fir tribe will never be planted as home plantations on good land, with the sole intention of profit, nor would it be advisable so to plant it. When plantations of firs are to be made as a forest, they should always be done upon an extensive scale at once, taking into the boundary all the waste or unproductive land that a proprietor has on his estate; and when once inclosed, it will be self-planting itself, although not all planted by art at one time. In this case, considering the inequality of the land, the distance or vicinity to sea-carriage, the difficulty of access to the plantation, &c. without having it in our power to take all these things into our consideration, it would be almost impossible to fix any true data for the value of an acre of firs. Scotch firs will grow upon almost any kind of land, however barren and unsightly, and exposed. Scotch firs are never profitable to cut down as a crop, till they are of size for roofing and cutting into boards, and this, in most situations, is not till they are forty years old, and supposing at the age of twenty, they had, as elsewhere directed, been thinned out to ten feet fully, tree from tree, which will leave 500 trees on an acre, which, reared up to forty years, will be worth at least fifteen shillings per ton; if near a shipping port L.375 per acre, for forty years growth. If the situation of a fir plantation will admit of their being reared up to seventy years old, by thinning to about twenty feet, the timber will then be fit for all purposes, meet with a ready market, and be more profitable to be cut down. A premature cutting of a fir plantation is always attended with disadvantage, as the timber must be applied to purposes of a trifling nature, and will not even bring its intrinsic value; it should therefore never be done too early, unless to make way for some more profitable crop. Scotch firs, however, is not altogether so unproductive, as may be seen by the above, as there is a fair rent for the land, and much more than probably the land would otherways pay, although the length of time is a bitter weight against them; yet when once planted, they are every year increasing in value and adding to the proprietor's income in one way or another.

The spruce fir, or pine, as it is called in Norway, and by many in this country, is a much better timber tree than what many consider it to be; for, although appearing very knotty and coarse, when cut up into boards it is a most useful kind of wood, and makes most excellent plain doors, flooring, or scantlings; and, although cut up into thin boards, it neither casts nor twists in the same degree as the other kinds do, although the reverse is generally dreaded. This tree is esteemed of great value by the Norwegians, as also the silver fir, both of which are well worthy of being reared in this country, but especially the spruce, as it grows very fast, and in wet soils where no other of the fir tribe will grow; and, although used at the age of forty years, is equally durable as at the age of eighty. Still the spruce and silver firs are more apt to be planted as ornamental trees than for the forest for profit, unless as aforesaid, in marshes, where the Scotch fir will not so readily grow.

SECTION XXIV.

OF THE LARCH FIR, ITS PURPOSES AND VALUE.

Of all fir trees the larch is esteemed the most valuable; and we have daily proofs before us that no tree advances so quickly in its growth. Almost all authors agree, that it not only thrives in the poorest soils, but it also grows to a prodigious height and magnitude; and that its wood is much esteemed by every person who is the least acquainted with it for its great durability. That it possesses an astonishing degree of incorruptibility in the open air, or under water, is not to be doubted. This fact is demonstrated by the history of the city of Venice, the greater part of which is said to have been built upon piles of larch fir wood, which are not only still fresh, although they have remained there for many hundreds of years, but they have also acquired such a degree of hardness as in some measure to resemble iron, so as to resist the edge of the best tempered tool. Let it only for a moment be considered how useful a wood, possessed of these valuable properties, might be to a country such as Britain, which depends so much upon its navy for its preservation, and particularly as it promises to be a ready substitute for the oak. Indeed, for certain purposes, it would seem to be more valuable.

Although the straightness of the larch does not make it suitable for knees in ship-building, yet it could be made to grow crooked for ribs; but supposing it were taken for outward planking, it might perhaps be more valuable for that purpose than the oak, as it would be much lighter and more tough, and possibly may resist the worms better in warm climates; at any rate, it would not be so apt to splinter from shot during the time of an engagement, which would doubtless be the means of saving useful lives that are not unfrequently lost by the splinters of the oak. Connected with the properties which have been mentioned, we ought to remember that as it is of much quicker growth, the nation could much more easily supply their demands with this kind of timber than with oak; all which considerations should make it meet the attention of every landholder who is a sincere friend to his country and his own interest.

The larch wood too is reckoned of such a quality as, compared with every other wood, to resist the fire in a superior degree, so as only to consume slowly in the midst of intense heat.

The inhabitants of Italy prize this tree very much. Besides using the timber for all valuable purposes, they use the bark for tanning leather; and, from the body of it, while growing, they extract that resinous balsam commonly known by the name of Venice Turpentine, which yields the country a very considerable revenue. The profits arising from it must be considerable; it being generally computed that a vigorous larch tree will yield seven or eight pounds of turpentine every year for forty or fifty years, and the usual selling price of this resin, I am informed, is about 6d. per pound: but supposing it were only 2d. or 2½d. per pound, the annual produce at the above rate, would amount to at least 1s, 6d. per tree. A Scotch acre contains 500 trees, at the distance of between 10 and 11 feet from each other; at which rate the annual produce of each acre would be L.37, 10s.

The larch fir tree, besides being excellent for ship-building, is supremely well adapted for all sorts of house carpentry, such as joists, roofing, flooring, and also bound work. Workmen, however, object to it, on account of its being so remarkably ill to season, as it is almost impossible to keep it from bending and twisting; so much so that most tradesmen say it is altogether impossible to make a straight piece of work from it; also, that it is so very hard when seasoned, as to make it very difficult to smooth with the plane. Many schemes have been tried to cure this evil, when cut up into thin boards or spars. Some adopt the method of steeping it, whilst in the log, in water for twelve months, and then take it out, and dry it properly before cutting up. In this case, it takes twelve months more to dry after it comes out of the water.

The following is the most efficient method that I could discover for seasoning larch wood, and I tried many different plans before I fell upon it; but this, experience has taught me, answers the purpose most effectually: In the summer of 1815 and 1816, I was employed to thin some plantations for James Johnstone, Esq. of Alva, on his estate of Denovan; and also in the same years, for Thomas Spottiswoode, Esq. of Dunnipace. The trees of both estates were of considerable size, and particularly those on the estate of Dunnipace—many of them containing betwixt thirty and forty solid feet of timber. As part of the trees on both estates were to be used by the proprietors for their own purposes, I had, the year before, cut down and barked a considerable number of these larch fir trees; which, being barked after being cut down, and exposed to the summer's sun, rent in such a manner as to render them of little or no use. To prevent this in future, if possible, I barked all the larch trees standing, and allowed them to remain in this state till autumn, which effectually prevented them from rending with the sun or drought. A number of trees on Dunnipace estate stood in this peeled state for two summers, and were then cut up; and Mr. Spottiswoode caused his carpenter to make from the timber of these trees some bound doors, which made an excellent job, no part of the wood casting or twisting, and which may still be seen in the porter's lodge at the eastern approach to Dunnipace house. Since that time I have myself used, and have frequently seen used by others, the timber of larch fir trees, after having stood twelve months with the bark taken off, then cut down, and immediately cut up into battens for flooring, and also made into bound doors and windows for the better sort of houses, with equal success. This is a clear proof that the plan of taking off the bark from the larch fir trees, some time previous to their being cut down, will not only prevent the timber from shrinking and twisting, but I am of opinion that it has also a tendency to harden the timber, and make it more durable, as it gradually throws out the resinous substance to the surface, and causing it, in a greater or less degree, to circulate through the whole timber; and this in so particular a manner, that the white wood of the tree is found equally as hard, and becomes as durable as the red wood. The consequence has been, that I am now decidedly of opinion, that the timber of a larch fir tree treated in this way, at thirty years of age, will be found equally durable with a tree cut down at the age of fifty years, treated in the ordinary way.

From all that has been stated, I now beg permission to say, that I am confident fir timber could be reared in this country to answer all the purposes that fir wood is required for, and that we might make ourselves quite independent of foreign countries for a supply of all kinds of fir timber.

The average price of larch fir timber, when sent to the ports of Leith, Glasgow, &c. when of sizes fit for cutting up into roofing, joisting, or flooring, is about two shillings or two and threepence per foot; but would fetch much higher prices from the tradesman if its qualities were better known; observing always, that all larch fir trees, when of size to be used for any of the aforesaid purposes, should be peeled standing, and allowed to remain standing, barked for one whole year at least. The method of barking them standing is simple and easy. See it explained more fully in the figure of peeling larch trees. I would also advise, that when the larch is to be used in ship-building, that it be stripped of its bark in April, and allowed to stand till November, as it is an amazing improvement to the timber, as it hardens and seasons it all alike round, bringing the white wood into a consistency as firm, and making it as durable as the heart. This, upon trial, in working the timber, I found it improved in a five-fold degree, to steeping it in water, or cutting it in autumn, or by any other means of seasoning whatever. That the larch fir is a profitable tree to plant and rear from the quickness of its growth and value of its timber, there is no doubt, so that the planter may rear the larch to advantage on land fit for any other kind of crop. But the larch has this particular advantage, that it will grow on very barren, bare, and exposed situations, provided there is a reasonable proportion of it planted together, not less than fifty acres in one clump; and if the land is barren, the situation bleak and cold, if 100 acres and upwards, so much the better. I may here observe, by the way, a most egregious error many planters have fallen into, in planting the larch fir along with the oak and other hard wood trees as nurses. The larch plants are put in from eight to eighteen inches high, the oaks and other hard wood which the larch firs are put in to shelter, are plants from twelve to twenty-four inches high. It is quite absurd and impossible to suppose that these larch firs will shelter the hard wood plants for two or even three years, as it will take them all that time to be of equal height with the oak or other hardwood plants; besides the larch is a bare tree in winter, and if in an exposed situation, the hard woods die, and the soil gets the blame of it. In all such cases and situations, when nurses are requisite, these nurses should be put in at least three years, and at proper distances, leaving room for the hardwoods before the hardwood trees intended for the crop is planted, and then you will insure success. As the larch firs will grow to maturity, or to a very considerable size as timber trees much closer on the ground than most others, 600 trees may be reared on a Scotch acre to thirty years old, when they may be thinned out to about 300 trees, which may stand to sixty years, at which age the larch may be said to be at its growth, or at least its maturity, and fit for all purposes. I may observe, by the way, that the plantation should be thinned out to between nine and ten feet tree from tree, when the trees are from six to ten feet in height, which leaves the 600 on the ground. Now at thirty years growth, these trees will be at least on an average fifteen feet a tree. I have often seen a whole plantation average twenty feet, but let us keep within the mark, which 600 trees at fifteen feet each, is 9000 feet, at 2s. per foot is L.900; Now, suppose the one half, or nearly so, which is only L.450, and the other half reared up to sixty years, these 300 trees at sixty years old will at least average fifty feet each, which is 15,000 feet, which at 2s. per foot, is L.1500 sterling per acre, for every acre to which add the L.450 reared at thirty years old, which is in all L.1950 per acre. I may remark here, that the trees at sixty years growth will make more put on an average, and be worth more per foot than the above; but as this will depend on the soil and situation, I do not wish to over-rate it. If the soil is good and the situation near a market, it will bring at least L.200 more per acre at the last cutting.

The only thing against a profitable forest of the fir tribe is after being cut, the ground must be planted up again, whereas by the most of the hardwoods it grows without that expense.

SECTION XXV.

OF THE USES AND VALUE OF SMALL HARD WOOD.

When hard wood trees of any description are sold by the solid cubic foot, when standing, the customary way of calculating the timber is by measuring the whole, with all branches, except such branches as do not exceed six inches in diameter, or four inches and a half on the side; for, if the purchaser is at the expense of cutting the trees down, &c. he is generally allowed all the wood of inferior branches to meet his expenses. When the branches of trees or young hard wood, under the above sizes, are sold by the foot, they are sold at an inferior or reduced price; and when young trees, or even the branches of large trees, are sold in this way—say for barrel staves, &c. as in Section XVI.—they are measured down as low as two and a half inches on the side of the square.

All the brush of hard wood under the sizes stated, or what may even be above it, if it is not fit for any other purpose, is sold by the ton weight. There are large quantities of this kind of wood to be met with in the cutting of coppice wood, cut at the age of from fifteen to twenty-five years, and which is termed ton wood. It is much used for the purpose of extracting, or, as it is generally termed, distilling from it a liquid which is used at bleachfields and calico print works, and now for making vinegar. When wood of this description is sent to Glasgow, where there are extensive works for the purpose of distilling it, it sells readily at from L.1, 2s. to L.1, 10s. per ton; but when there are large cuttings, particularly of young woods, it is worth while to erect boilers near the wood to distil it, as these boilers can be erected at no great expense; and, in this case, the liquid is easily carried in casks to where it is consumed, at less expense than the rough timber could be; of course, it will pay much better. Small wood of this description is also used for charcoal; but, in distilling it, there is part of it made into charcoal, which will supply the demand of that article; so that is by far the most profitable way, when there is any great quantity to dispose of, to erect boilers and distil it; unless where the local situation of the wood will admit of its being shipped at a small expense, and carried to where the works mentioned are carried on.

All kinds of wood will give the extract in question, excepting fir; but oak, ash, Spanish chesnut, and birch, are the best. In many parts of the Highlands this ton or brush wood is used for fuel;

and where there is no coal to be had but at a great expense, it will sometimes be found to pay better to sell it as fire-wood than to dispose of it in any other way. Oak coppice wood also furnishes great quantities of spoke-wood, which is likewise considered under the size of measurable timber. These are cut for chaise-wheel spokes: long spokes are from 30 to 32 inches by 3½ inches broad, and 1½ inch thick, and the short ones for the same purpose, from 22 to 24 inches long, and same size otherwise; cart-wheel spokes, from 26 to 28 inches long, 4 inches broad by 2 thick. These are the sizes they require to stand when rough-blocked from the axe or saw; and, in this way, they are sold at the prices as in Section XVII.

As these spokes must not have the heart of the tree in them, they are, after being cross cut to the proper length, either split through the middle with an axe, or cut with a saw, and are most generally made from the cleanest of the wood. Small wood, when sold by the solid or cubic foot, for spokes, sells at two shillings per foot, and is measured down to three inches on the side of the square. When charcoal is principally wanted, the method of burning it is the following:

To burn it in a smothered fire, a hearth of from twelve to twenty feet in diameter is prepared on a convenient spot, to which the wood is brought, cut into lengths of from eighteen inches to three feet. These are piled into a proper form, an aperture being preserved in the middle, all along from bottom to top. The billets are disposed around it in directions alternately horizontal and perpendicular, inclined to the centre till the mass be brought to a height of six or eight feet, and gradually drawn in towards the top in form of a cone. If the wood is very green or wet, the interstices must be filled up as the building goes on with dry birch wood, or some such thing, so as the whole will stand compact and firm; and having done so, the whole must be coated over with turf, to which is sometimes added a covering of fine mould, or a mixture of that with charcoal dust.

The stack is to be set on fire, by throwing into the void space in the centre some pieces of charcoal, or of any dry wood, with some live coals; and these may be added till the whole wood round the middle aperture is ignited; then stop up that chimney, though not so closely but that the smoke may continue to issue from it. At the same time vents must be opened in other parts of the pile, which are to be shut in their turn also, and others opened; and so on successively during the whole progress of the operation, that there may be always a sufficient supply of external air to keep alive the burning, and that it may go on briskly in all parts of the pile for two, three, or more days. According as the wood is more or less green, will this care require to be continued, till the thick and gross clouds of smoke have disappeared, and the flames no longer issue with impetuosity through the vents, when it is judged that the wood is fully charred. The spiracles are then to be all closed up very exactly with a mixture of earth and charcoal dust, when the fire will go out by degrees: for which purpose, a sufficient time having been allowed, the covering may be taken off, and the charcoal will be found ready for use. Some little differences may occur in the manner of conducting this process. The best way is to employ persons who have been accustomed to the like work. Charcoal is found to vary in its qualities, retaining generally something in common with the substances respectively from which it has been formed. According to these characteristic distinctions, it is in request for different purposes. Thus, for the making of gunpowder, &c. the coals of alder, birch, willow, hazel, and lime, are considered the most suitable; and for the reduction of the metallic calces, those of the heavier woods, as the oak and beech, are preferred; and all of these kinds are considered of best quality when used without the bark, and bring from twenty to forty shillings more per ton at foundries and powder-works, and have been selling for some time back, when delivered at these works, at from L.3, 10s. to L.6 per ton.

SECTION XXVI.

OF THE BARK OF TREES THAT MAY BE USED, AND IS MOST GENERALLY USED IN TANNING, WITH ITS VALUE.

I HAVE been informed, that a great many different kinds of bark are used in the dying of cloth; but with this I am not sufficiently acquainted. I shall therefore confine myself to those kinds which are, or might be, used for tanning leather, as this is the only sort of manufactory that consumes it to any great extent. Those trees, whose bark is universally used for tanning, are the oak, the Spanish chesnut, the birch, the larch, and the rowan tree. The average prices of these different kinds for the years 1817, 1818, and 1819, and adding the different prices in all the shires in Scotland together for that period, taking the medium for the average, stand as follows :—

Best Scotch oak bark, commonly known by the name of Highland coppice bark, per ton,*	L.14	15	4
Spanish chesnut, do. per do.	12	10	0
Birch do. per do.	7	10	0
Rowan tree, do. per do.	7	7	0
Larch fir, do. per do.	7	0	0

Average prices of bark for the years 1821, 1822, 1823.

Best oak per ton,	L.12	17	4
Spanish chesnut,	9	15	0
Birch,	6	6	0
Rowan tree,	5	0	0
Larch fir,	5	5	0

Average prices of bark for the years 1825, 1826, 1827.

Best oak bark at London market,†	L.14	15	0
do. at Liverpool do.	13	10	0
do. at Dublin do.	14	0	0
do. at the principal Tan-works throughout the most of Scotland,	12	12	0

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* The prices here stated are given upon the supposition that the bark is delivered at the tan-yard in any county town, or at a sea-port near the works.

† Observe, the most of the bark, and that of the best quality, sent to London, Liverpool, and Dublin markets, of home growth, is from Wales in England. But there is also vast quantities of foreign bark imported into the London and Liverpool markets; some of the French and Dutch coppice oak bark sells at the same price as the Welsh bark; there is also a large quantity imported from America, Russia, and Norway, but it is of a much coarser and inferior quality, and brings a much lower price. There is a small duty charged by government on the importation of foreign bark into Britain. Bark sent to Ireland from England or Scotland receive a premium from government of so much per ton. The information I got at Dublin was 20s. per

Spanish chesnut	at London,	. .	L.11	11	0
do.	at Liverpool,	. .	10	0	0
do.	at Dublin,	. .	11	0	0
do.	throughout Scotland,	.	9	0	0
Birch	at London,	. . . .	7	7	0
do.	at Liverpool	. .	7	0	0
do.	at Dublin,	. .	7	5	0
do.	throughout Scotland,	.	5	15	0
Larch fir bark	at London,	. .	7	0	0
do.	at Liverpool,	. .	6	6	0
do.	at Dublin,	. .	6	6	0
do.	at Belfast,	. .	6	0	0
do.	throughout Scotland,	.	5	10	0

The oak bark of full grown, or old oak trees, as it is generally very corky, sells L.2 and sometimes L.2, 10s. per ton lower than the young or coppice oak bark.—All the above different kinds of bark during the late war, were at least four pounds per ton higher in price than the above statement.

As it is agreed on by all, that the bark of oak and other trees in general is only useful in tanning, on account of its astringent quality, which has the effect of contracting the pores of the leather, so as to resist moisture, whilst at the same time it tends much to the preservation of the leather; we may therefore naturally conclude that the bark of any tree, or even of any vegetable, that is possess-

ton; at Belfast 15s. per ton; and, by a letter from Cork, it is stated at 25s. per ton. I am of opinion that there must be some mistake, as I should suppose it will be the same throughout Ireland.

ed of an astringent quality, will be of use in this respect, proportionally to its degree of astringency; but this is a quality for which the bark of trees in general is more particularly remarkable, as there are very few trees which do not possess it either in a greater or a less degree. With the view, therefore, of discovering the degree of astringent qualities the bark of every kind of tree possesses, and to compare it with that of the oak, which would show at once the comparative value of each, I applied to a medical gentleman, conversant with chemistry, to inform me how I could best arrive at the object I had in view. He had little hesitation in saying he could point out an effectual method. His plan was, by taking an equal quantity of the liquor of each kind of bark, and the same quantity of oak bark liquor, and putting them into transparent glass vessels of the same size and form. This being done with each of the glasses, there should be permitted to fall a drop or two, according to the quantity of liquor, of the solution of green vitriol. By this means will be seen which of the liquids possesses in the highest degree the quality of astringency, as the liquor will immediately change to a bluish colour. The deepness of the hue or tinge each takes, points out the proportion of astringency belonging to each.*

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* See this more particularly explained and exemplified in my miscellaneous reports published in July 1827, where is also a

This trial I made by taking a small quantity of dried oak bark, and an equal quantity of the kinds after mentioned; I steeped them separately in an equal quantity of water for three months, stirring them frequently. I also tried the same, by boiling each kind, putting the decoction of each into a glass, and putting into them the same quantity of vitriol; and on trying them in this way, the degree of astringency was as follows:—

1. The oak struck a deeper tinge than any of the others.

2. The ash and hornbeam. These two were nearly equal, and very little inferior to the oak.

3. The Spanish chesnut, nearly equal to the oak.

4. The green willow, the bay-leaved willow, the common hoop willow, the gray willow, and the Huntingdon willow, were all nearly alike, but all a degree fainter than even the chesnut.

5. The birch and the beech a considerable degree weaker than the Spanish chesnut, and not nearly equal to the ash.

3. The rowan tree, or mountain ash, a great deal inferior even to the birch, and also to the willows.

method given for discovering, in a short time, the strength and different qualities of all kinds of bark, by which the value of each may be ascertained.

7. The common broom, when taking the bark alone, nearly equal to the oak; but when taking the small twigs, and chopping it along with the bark, only equal to the rowan tree.

8. The laburnum, a degree weaker than the rowan tree.

9. The larch fir, equal to the birch.

10. The spruce and silver fir, a degree weaker than the larch.

11. The common Scotch fir, a small degree of astringency, but much weaker than any of the other firs.

12. The bramble bush, taking bark and all boiled, equal to the chesnut.

13. The saw dust of the oak timber, when boiled, equal to the chesnut, and very little inferior to the ash bark when steeped.

14. The small brush of the tops of oak trees, chopped small and boiled, equal to the ash.

All these kinds, as they possess a considerable degree of astringency, will tan leather; but the beech bark is so very thin, and so difficult to be separated from the tree, that it can scarcely be obtained; nor would the bark of the laburnum be worth while. The ash, when it is reared in any quantities, in natural woods, could be very easily peeled without much injury to the timber when it is small; but when the tree is large, it would injure the timber very much to take the bark off it. But when ash bark can be obtained, it will be found very little inferior to the oak, and stronger than either the birch or the larch, which is in general used.

The Turkey oak is not yet planted in any great quantity as a forest tree, but the following letter, from an intelligent forester, will show that it may be planted to advantage.

Experiment, Argyleshire,
2d June, 1827.

Dear Sir,—I have made an attempt to ascertain whether the common Scotch oak or the Turkey oak bore the greater weight of bark, which I have compared with as much exactness as I could, and I hope the result will be satisfactory. I selected trees of each sort, which, to appearance, had the same chance of growing,—their health, exposure, and the soil they grew in, being the same, of the same age, 16 years, and each pair admeasuring the same over the bark. The common oak bark lost seven eighteenths of its weight when green in drying. The Turkey oak bark lost eight eighteenths, and weighed when dry from one sixteenth to three-sixteenths, or at an average about one-eight more than the common oak bark. Wishing to know the relative value of each kind of bark, I took 480 grains of the dry bark, and proceeded to ascertain the quantity of tannin or the tanning principle contained in each kind by Sir Humphrey Davy's method. (See his Elements of Agricultural Chemistry, 2d edit. page 91.)

I found the above quantity of common oak bark to contain 36 grains of tannin. And the same quantity of Turkey oak bark to contain 28 and four-fifths grains of tannin. So that, when the common oak bark is worth L.9 per ton. to the tanner, the Turkey oak bark is only worth about L.7 per ton.

From the above experiment, it appears that the bark, from an acre of common oak, is nearly one-tenth more valuable than from an acre of Turkey oak. Nothwithstanding this difference of value, however, I am of opinion, that, in particular situations, such as well sheltered places, where the soil is of a light sandy nature, it might be more profitable to plant such places with Turkey oak instead of common oak, as, from the rapidity with which Turkey oak shoots forth in such situations above the common oak, I would suppose that it might probably turn out double the weight of bark.

I will feel much obliged by your remarks on the above at your convenience. And remain,

Dear Sir,
Your most obedient servant,
James Gow, Jun.

To Mr. Monteath.

I also tried the plant called the dock, which is to be found almost every where in great quantities. Its astringent quality is of nearly the same strength as the broom. I therefore think the common broom, the bramble, and the dock, might be good substitutes for the bark of trees in tanning leather; but granting these substitutes should ever be resorted to in place of the bark of the oak, or any other tree, it will not much lessen the value of the timber. To convince the reader of this, he will please look back to Section XI. where the value of the foot of oak timber is placed at 4s.; and considering the sizes of the trees there mentioned, there is only about 6d. per foot reckoned on the bark.

SECTION XXVII.

THE METHOD OF VALUING AND ASCERTAINING THE QUANTITY OF BARK, &c. ON AN OAK COPPICE WOOD.

I HAVE frequently been applied to by foresters and others to give some description of the readiest and surest method of ascertaining the quantity of bark, &c. and consequently, the value of a coppice wood before it was cut down. I lie under many a promise to perform this task; and I confess it was much more difficult than I at first imagined. Were I desired to go to a growing wood of any description, of the extent of from one to ten thousand acres, and to give its value, I would find no difficulty in giving the value of wood and bark, &c. and that too within five per cent. either way. But to say that I, or any man, could lay down a rule for doing this work, without the person being a little in the practice of it, is altogether impossible. Were it measurable timber, as will be afterwards shown, it would be more easy; but in taking young natural wood, where there are perhaps a thousand stools on each acre, and these averaging five or six stems, or shoots, from every stool, and not one of them measurable timber, (even this, however, were in some degree tolerably easy, if you have the number of acres, and can ascertain the number of stools and stems on each acre,) the result must, in a great measure, be ascertained by partly guessing at the average quantity of bark, &c. each stool will produce. But when the ground is not measured, it must be worse. And though the whole wood ground were measured, if a person has not each acre by itself, in order to ascertain the number of stools on each, and the average number of stems from each stool, it is impossible to proceed in this work with any accuracy. And it is still more difficult when one has no knowledge of the measurement of the ground; supposing a person had, as it is always the crop on the ground that must be taken, where the crop is exceedingly various, and the ground in parts almost inaccessible, it is almost impossible in this case, without having had a little experience in the line, for any person, however plain it may be laid down before him on paper, to pretend to ascertain the value with any degree of accuracy.

Besides, the situation and soil will affect the weight of the bark very considerably. The quality of the timber, the thriving or healthiness of the growth of the woods at the time of valuing, will also make the weight of the bark vary. If a coppice or natural oak wood has a northerly or a north-east exposure, the timber will be in general more durable and hardy, but the bark not so thick as when the woods have a southern exposure. In low dens, where the wood is well sheltered from all quarters, and where the growth must be more rapid, the bark will be thicker, and weigh heavier than in either of the former situations, but the timber will be more spongy. The poorest and most rocky soils produce the best or hardest timber, but not so thick or strong bark as better soils would do. As to quality, all foresters agree in this respect, that wherever oak timber, young or old trees, is well hearted, that is to say, much red wood in it, this is the best of the oak timber; but the bark on trees of this kind is not so good and thick as when the timber has more white or sap wood in it. Also, if the tree is very healthy and thriving, the bark will be better and easier peeled than when the wood of the tree becomes stunted in the growth, and has a great many dead branches on it. In the latter case, the bark too will be a great deal worse to separate from it, and will require a great deal more beating to raise or take off the bark; and in this case the bark is more dry, and will not weigh so heavy as when the wood is in a thriving state.

In valuing a wood that a person is an entire stranger to, he must consider all these things, and make his calculations accordingly; and having pierced the bark on several of the trees in different places of the wood, and ascertained its thickness, having some experience of what he is going to be about, I would, in order to assist him in the valuation, submit to his consideration the following observations and method :—

Suppose an acre of coppice oak wood, at 15 years of age, to contain, at 8 feet distance from each other, 856 stools, which an acre of ordinary good ground is very capable of bearing, and these stools averaging 5 stems from each, which is 4275 stems on an acre, these stems, at the above age, will, at the least, average 2 lbs. of bark each stem, which is 3 tons 16 cwt. 1 qr. 10 lbs. at L.14 per ton, is . .		L.53 8 9
Which is 15s. 4d. less than the average price for these last three years. *(See Sect. XXV.)*		
16 tons of brush timber in the acre as above, at 10s. per ton, ...		8 0 0
		L.61 8 9
Deduct expense of peeling the bark, supposing the women employed at 1s. and the men at 2s. 6d. per day each, is L.2, 15s.[*] per ton, for 3 tons, 16 cwt. 1 qr. 10 lbs. . .	L.10 9 11	
Deduct carriage to the tan-yard, at L.1 per ton, . .	3 16 4	L.14 6 3
Value of one acre of coppice at 15 years of age,		L.46 2 6

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[*] Observe the bark can be peeled and manufactured for much less per ton now, wages being lower; it is often let out by the ton at 32s., and in many places as low as 28s. per ton, including chopping and weighing over to the tanner.

Supposing the coppice 20 years of age, and each acre containing 855 stools, averaging 5 stems from every stool, is 4275. Average quantity of bark on each stem is 3 lbs. which is 5 tons, 14 cwt. 2 qrs. 1 lb. which, at L.14 per ton, is				L.80	3	1½
10 tons of brush wood, at 10s. per do.				5	0	0
1600 spokes, at L.2 per 100,				32	0	0
				L.117	3	1½
Deduct expense of blocking spokes, at 4s. 6d. per 100,	L.3	10	0			
Do. expense of peeling, at L.2, 15s. per ton,	15	14	10			
Do. carriage at L.1 per ton,	5	14	6			
				L.24	19	4
Value at 20 years,				L.92	3	9½
Supposing the coppice 25 years of age, and 855 stools on an acre, averaging 4 stems on every stool, is 3420; and averaging 5½ lbs. of bark on each stem, 8 tons 1 qr. 7 lbs. at L.14 per ton,				L.112	4	1½
Eleven tons of brushwood, at 10s. per do.				5	10	0
2500 spokes, at 2s. per 100,				50	0	0
				L.167	14	1½
Deduct expense of peeling at L.2, 15s.	L.22	0	10½			
Ditto for blocking spokes, at 4s. 6d. per 100,	5	12	6			
Ditto for carriage, at L.1 per ton,	8	0	9			
				35	14	1½
Value at 25 years,				L.132	0	0
Supposing the coppice 30 years of age, and 855 stools in an acre, averaging 4 stems from every stool, is 3420 stems, averaging 8 lbs. of bark on each stem, is 12 tons 4 cwt. 1 qr. 4 lbs, at L.14. per ton,				L.171	0	0
Six tons of brushwood, at 10s. per do.				3	0	0
3800 spokes, at L.2 per 100,				76	0	0
710 feet of measurable timber, at 2s. 6d. per foot,				88	15	0
Carry over,				L.338	15	0

Brought forward,		L.338 15 0
Deduct expense of peeling, at L.2, 15s. per ton,	L.33 11 9	
Ditto for blocking 3800 spokes, at 4s. 6d. per 100,	8 11 0	
Carriage of bark to the tan-yard, at L.1 per ton,	12 4 3	
		54 7 0
Value at 30 years of age,		L.284 8 0

The preceding statement is what an acre of ordinary good wood land, laid out for oak coppice, is very capable of producing, when it is properly trained up; and those persons who are acquainted with cutting and managing natural oak wood, will at once see that I am rather below than above the truth with my estimate. The nearness or distance of the situation of the wood to or from the market for the bark, will either lessen or increase the carriage, as will also the alteration in wages make either the expense of manufacturing less or more; but for all these things allowances must be made.

I have made no allowance for the cartage of the spokes, because there is scarcely any part in the country but there is a wright that requires that article; and he generally gives that price for them in the wood. But if the quantity should be too great for that particular part of the country, it is easy to make allowance for the carriage. I have allowed 6d. on the foot of the measurable timber to carry it to a sea-port, &c.

The surest method of estimating the crop as it stands on the ground, without regard to the acres of the measurement of the land, is to count the stools into twenties, and to take the average number of stems or shoots on every twenty stools; then take the average quantity of bark on every stem, the average quantity of spokes every stool will produce, the average quantity of measurable timber in every stool, and the average quantity of brushwood on every stool. Having set down all these carefully and accurately in a memorandum-book, go through the whole wood in the same way, and add the whole together. Take the bark by the ton, say at the nearest place you expect to sell it; the spokes by the hundred, at where you expect to deliver them; the measurable timber by the foot, at the port at which you expect to sell it; and the brushwood by the ton;—add these together; then make an allowance for the carriage of your bark, spokes, measurable timber, and the expense of cutting and peeling the bark, also the blocking of the spokes;—add these together, and deduct the amount from the former sum, and the remainder will be the value of the wood. The readiest method of counting the stools is, to cause two men to take a line, say about a hundred feet long or more, and passing the line round as many of those stools as it will inclose, the one man standing still while the other moves round a new number of stools, and count always the stools betwixt the two lines, causing the one man to move the one time with the line, whilst the other man stands still, and so on alternately. The valuator at the same time taking care to average every twenty stools as they go on, before losing sight of the counted stools. This way too is a very speedy and sure method of counting the number of trees in any plantation. Or the stools of a coppice wood may be counted and averaged by two men going parallel to each other, and the person valuing going betwixt them; the two men putting up marks with moss, or pieces of white paper on a branch of the stools; the one man going always back by the last laid marks, and the valuator always counting and averaging the stools betwixt the newly laid and the late laid marks, counting and averaging the stools, always as the men go on, taking only 20, or even 10 stools, at a time. To those who have been in the practice of doing this frequently, it will be found very easy, and will be done very speedily, and with a very considerable degree of accuracy. The proper method of learning to do this correctly is, when a person cuts an oak wood for the first time, (or even were the work repeated several times,) he should, in order to make himself perfectly acquainted with ascertaining the average quantity of bark that a stool, or even a stem or a shoot from a stool will produce, go before the peelers, and select a stool or shoot, and after having examined it narrowly, he supposes it to produce a certain quantity of bark, and marks this down in his memorandum-book. He then causes a person to peel it by itself, dry it, and carefully tie it up and weigh it, and compare it with the weight he supposed it to produce, and he will at once see how near his calculation came to the truth. By frequently repeating this, he will soon be enabled to come near the truth, without making such a trial, and even without being at so much trouble as to dry the bark itself. I have often weighed it after being peeled, and allowed one-third part of the weight for the sap, which in bark from 15 to 30 years old will be found to be very near the true weight of it after it is dry; but if the bark is much older, or if it be the bark of large trees, it will take considerably more than one-third part of the green bark to make the weight hold out when dried. I have also tried it, by measuring the stems of a stool, and reducing them to solid feet and inches; and I have found this to be a very satisfactory way of finding the quantity of bark.

For example, a stem of oak from a natural stool —suppose it to measure in girth 2 inches by 7 feet long, will contain 2 solid inches and one-third of an inch, according to the measurement of Hoppus. This stem or shoot will produce 2 lbs. 2 oz. of bark. Again, a stem or shoot of natural oak, measuring 4 inches in girth, by 9 feet in length, will be found to contain 1 solid foot of wood, and will produce 13½ lbs. of bark. I have seen many shoots of this size, when all the branches were healthy and thriving, produce 17 lbs. 8 oz. Let it be observed here, that natural shoots of oak will produce more bark according to their measurement than young oak trees reared from the plant will do, as the trees from the plant require more pruning than those from the natural stool; for the rougher the coppice is, or the more branches are kept on, the more bark it will produce. See Section IX. of this work, also the plate of coppice trees. If it is intended to cut the coppice very young, little or no pruning is necessary.

If the forester will take the trouble to try all these different methods in the way directed, as I have done; he will find them to come very near the truth, in the three kingdoms. As to the plan of ascertaining it by solid feet or inches in very small stems or trees, the bark will vary a little, according to the quantity of branches peeled below what was measured.

I am aware, that here I run the risk of not falling in with the opinions of some of my readers, and even with many of those who pretend to be good judges of the value of oak coppice wood. Such will insist that it is impossible for an acre of coppice oak wood, at fifteen years of age, to produce L.47, 2s. 6d.; or that an acre, at twenty years of age, will produce L.92, 1s. 9½d.; but particularly, that an acre, at twenty-five years of age, will produce L.132, 12s. 6d.; and beyond all credibility, that an acre, at thirty years of age, will produce L.284, 8s. In answer to this, however, I might point out the place where such results were obtained, and produce evidence of the facts; nor were these made on the best natural wood I have seen. But if the reader who doubts will consider the following, and make trial of it in ordinary good coppice wood, he will at once acknowledge that I am rather under than above the real calculation. It surely need not stagger the belief of any person who is in the smallest degree acquainted with rearing of natural oak woods, to see a natural oak stool at fifteen years of age, bearing five stems each, which will make two paling stobs, and of course will measure fully more than two solid inches, and one-third of an inch. Nor is it at all uncommon to see thousands of natural stools of oak at thirty years old, producing four stems, each of which will average one solid foot; and of course will produce upwards of three stones of bark, which will be seen to be far above the calculation, either at fifteen or thirty years old; but if I were to select the best growths I have seen at the different ages mentioned, I should go far above either of these calculations. But I have been careful in the foregoing, to select only those acres, by carefully attending to the cutting and rearing up of which, in the manner herein laid down, the poorest soil of natural wood land (marshes excepted) in Scotland, is capable of producing.

Were I to give instances of the growths of natural oak stools I have seen on good soils, I should not exceed the bounds of truth, although I were to double the proceeds herein stated.—For the sake of those not acquainted with rearing wood, allow me to give the four following examples, taken from actual measurement.

A TABLE, *showing the Growth of several Natural Stools and Seedlings of Oak, taken from actual Measurement.*

PLACES WHERE THE DIFFERENT MEASUREMENTS WERE TAKEN.	Ages of the Growth.	First Stool.	Second Stool.	ThirdStool.	Number of stems in all.	Average measure of each stem.		Measurement of the whole put together.	
						Feet.	*Inches.*	*Feet.*	*Inches.*
On the estate of Ormiston Hall, in East Lothian, taken in 1804.	30	5 stems.	4 stems.	3 stems.	12	5	6	66	0
In Glen Shirra, near Inverary, Argyleshire, taken in 1810.	25	6 stems.	5 stems.	4 stems.	15	3	6	52	6
Three stools of Ash, on the estate of Boquhan, in Stirlingshire, taken in 1812.	20	6 stems.	5 stems.	4 stems.	15	3	4	50	0
Bankend wood, estate of Touchadam, Stirlingshire, which I cut in 1804; measurements taken in 1820.	16	8 stems.	6 stems.	4 stems.	18	0	4	6	0

Seedlings in the said coppice, when the wood was cut, must have measured at least three inches in circumference, three feet from the ground, and from four to six feet high. These were the largest sizes left in Bankend wood, when cut. At Ormiston Hall, in 1804, twelve of the best seedlings put together in said wood only measured forty feet nine inches. In Glen Shirra, in 1810, fifteen of the best of the seedlings in said wood, put together, only thirty-three feet seven inches. In the wood of Bankend, which wood was still growing, (in 1820,) eighteen of the best seedlings only measure four feet five inches.—The bark is included in the foregoing measurements.

By this statement it will be seen, that natural shoots of oak make far more rapid growth than seedlings, or from the plant; nor are they nearly so liable to fail in rearing.

I grant that the foregoing measurements were taken from very thriving stools, and which stools grew on a good soil; but it would be very possible (and no one who is acquainted with the subject will doubt it) to have 600 stools on an acre of good land, which would place each at ten feet distance from each other every way, and these, at the age of thirty years, to average four stems from each stool. But granting they only were to average three solid feet from each stem, which is less than those at twenty-five years of age, there would be 2400 stems on an acre, average three feet each, which is 7200 feet, which, at 2s. 6d. per foot, (a low price, including bark) is no less than L.900 Sterling per acre at thirty years old. Who would not think oak woods worthy their attention in rearing, after considering what it is possible to gain by them? I have seen, since the above was written, one acre of coppice wood, at twenty-four years old, produce of wood and bark L.290 Sterling, and the bark only sold at L.11, 11s. per ton.

I have lately been favoured, by J. Francis Erskine of Mar, Esq. with the date of planting some large oak trees, which I cut on his estate of Alloa in 1817. They were planted in 1706 and 1707. Many of them measured upwards of 140 solid feet; one in particular, which grew between a lime and a poplar, not more than eight feet distant from each other, measured sixty-two feet nine inches in length, of a straight bole, and the girth on the side of the square 13¾ inches. A poplar, planted at the same time, and cut in 1817 measured 235 solid feet. Many oak trees planted at the same time, still stand on the same ground, and will measure 150 feet.

The following is the actual measurement of the growths of four natural stools consisting of oak, Spanish chesnut, ash, and plane. The stool was regularly thinned the second year after being cut, according to the method of Section X., &c.; with their actual increase in growth as measured again in 1827. Observe the measurements were taken in the autumn of each year after the year's growth was finished.

No. 1. An Oak Stool

cut in 1815, thinned in 1816 to three stems, measured in 1818, average measure in height of each, 14 feet 6 inches.

Inches round immediately above the stool,	No. 1.	2 inches.
	2.	2½
	3.	3

No. 2. A Spanish Chesnut Stool

cut in 1815, thinned in 1816 to three stems, measured in 1818, average height 16 feet 8 inches.

Inches round immediately above the stool,	No. 1.	3 inches
	2.	3¼
	3.	4

No. 3. An Ash Stool

cut in 1815, thinned in 1816 to three stems, measured in 1818, average height 13 feet 6 inches.

Inches round immediately above the stool,	No. 1.	1½ inches.
	2.	2¼
	3.	2¾

No. 4. A Planetree Stool

cut in 1815, thinned in 1816 to three stems, measured in 1818, average height 12 feet 3 inches.

Inches round immediately above the stool,	No. 1.	1½ inches.
	2.	1¾
	3.	2¼

Here follows the actual and individual increase in growth of each stem.

No. 1. Oak measured again in autumn 1827, average height of the three stems 28 feet 11 inches.

Inc. round,	No. 1.	17 above the stool	at 3 feet up	15 inches.
	2.	17¾		15¼
	3.	18		15¾

No. 2. Spanish Chesnut measured again in autumn 1827, average height of the three stems 35 feet 11 inches.

				Inches.
Inc. round,	No. 1.	19 above the stool	at 3 ft. up each stem	16½
	2.	19½		17
	3.	20		17¾

No. 3. An Ash measured again in autumn 1827, average height of the three stems, 25 feet.

Inc. round,	No. 1.	14¾ above the stool	at 3 feet up,	12 inches.
	2	15½		12¼
	3.	16		12¾

No. 4. A Plane measured again in autumn 1827, average height of the three stems, 23 feet 4 inches.

Inc. round,	No. 1.	14 above the stool	at 3 feet up,	12 inches.
	2.	14½		12
	3.	25		12¼

These are immense and most magnificent growths. for their age, yet the reader will be surprised to observe that the Spanish chesnut, which is not generally reared from cuttings, has made more progress than the others; that the Spanish chesnut does grow fully as rapidly from the cut stool, no one will now, I presume, deny; but the situation of the one here taken was favourable to its growth, being in a belt of ornamental trees, and was well protected and sheltered, and when cut was a tree of about fifty years old, but had been overtopped and rather stunted in its growth. The root, when cut and dressed up for the growth, was however quite fresh, and about twenty-two inches in diameter; and although from a stool of this size, more stems could easily have been reared, yet one good tree was (from the others on the ground) sufficient to fill up the gap, to rear up to maturity as a standing timber tree, yet from its very rapid, luxuriant, and straight up growths, there will be plenty of room for all the three stems to maturity, as the neighbouring trees have made but little progress in filling up the space since it was cut, and should no accident befal the three stems, in other ten years more, each of the stems will be larger trees, and have more solid timber than many of its neighbours in the same belt that will have, by that time, stood for about seventy years, and besides three trees for one in the same space and in so short a time. The oak, ash, and plane tree were cut in a regular hag of natural coppice wood, the second cuttings were from very healthy stools; still they were rather in an exposed situation, and it is worthy of observation, that although they did not make such a great push as to height as the Spanish chesnut, yet they have made very extraordinary growths, particularly as to thickness, notwithstanding their being within one fourth of an English mile of the sea, and in rising ground, exposed to its breezes, and about half way up betwixt the top of the hill and the level of the sea; indeed all things considered, they are most beautiful growths, and the best I had ever seen. Still having, for a number of years back, kept a kind of journal of the growths and increasing growths of natural shoots and trees, I might give a very great number of growths little inferior to those above mentioned; but were I to begin to this I would soon swell up the volume ten times above the bounds limited for it. Although I have all along, from the first edition of the Forester's Guide to this third edition, and in almost all reports of my surveys, been a most strenuous advocate for rearing trees from natural cuttings, as the most profitable, speedy, and expedient, either for coppice cutting or rearing up standing timber trees to maturity, but above all, for ship building timber crooks, which never has, and I believe never can, nor never will be confuted, still it would be presumption in me were I not to mention growths of extraordinary magnitude taken notice of by other authors of high respectability. These, however, are chiefly single trees from the plant, and of course not so profitable as from a natural stool. Where profit is the sole object, three trees can be reared up in the place of one, and of course three times more valuable, even granting their growths to be on an equal ratio. Although the following growths from the plant are far beyond any thing I have ever seen in all the course of my profession, coming from a proprietor and a gentleman of high respectability, will nor does not in my mind admit of the shadow of a doubt. It would have been, I do confess, still more satisfactory to some of my readers had the gentleman, who I shall immediately refer to, given us the size of the plants at the time of planting. The impression, however, on my mind is, that the plants when put in would not exceed the ordinary size of plants taken from the nursery to be planted in a field or plantation. The following is from a most excellent little pamphlet, published in the year 1827, by William Withers, Esq. of Holt, county of Norfolk, addressed to the Society for the Encouragement of Arts, Manufactures, and Commerce, on the Planting and Rearing of Forest Trees.

No. 1. Wynch Elm, planted in 1811.

Height, 21 feet 8 inches.

Inches round,
21 at bottom.
19 at 1 foot up.
13 at 6 feet up.

No. 2. Oak, planted in 1811.

Height, 23 feet 5 inches.

Inches round,
20 at the bottom.
16 at 1 foot up.
13 at 6 feet up.

No. 3. Ash, planted in 1811.

Height, 18 feet 8 inches.

Inches round,
14 at the bottom.
11 at 1 foot up.
9 at 6 feet up.

No. 4. Sycamore, planted in 1811.

Height, 20 feet.

Inches round,
16 at the bottom.
14 at 1 foot up.
11 at 6 feet up.

No. 3. Locust, planted in 1821, and standing within 8 feet of the four last mentioned trees.

Height, 21 feet.

Inches round,
15 at the bottom.
14 at 1 foot up.
10½ at 6 feet up.

Planted in 1818, on land deep trenched and manured.

No. 6. Oak.

Height, 20 feet.

Inches round,
18 at the bottom.
14 at 1 foot up.
10 at 6 feet up.

No. 9. Oak.

Height, 18 feet.

Inches round,
15 at the bottom.
11¾ at 1 foot up.
9 at 6 feet up.

No. 8. Spanish Chesnut.

Height, 18 feet.

Inches round,
24 at the bottom.
20 at 1 foot up.
13 at 6 feet up.

No. 9. Locust, planted in 1821.

Height, 19 feet 6 inches.

Inches round,
14 at the bottom.
12½ at 1 foot up.
19¾ at 6 feet up.

Planted in 1817.

No. 10. Chichester Elm.

Height, 28 feet 4 inches.

Inches round,
23 at the bottom.
19 at 1 foot up.
16 at 6 feet up.

No. 11. Chichester Elm on contiguous border not so well prepared.

Height, 20 feet.

Inches round,
16 at the bottom.
12 at 1 foot up.
9½ at 6 feet up.

No. 12. Luccomb Oak.

Height 19 feet 9 inches.

No. 13. Hertfordshire Elm.

Height, 18 feet.

Inches round,
17 at the bottom.
14 at 1 foot up.
9¾ at 6 feet up.

No. 14. Spanish Chesnut.

Height, 17 feet 8 inches.

Inches round,
20 at the bottom.
18 at 1 foot up.
10 at 6 feet up.

No. 15. Spanish Chesnut.

Height, 16 feet 6 inches.

Inches round,
21 at the bottom.
18 at 1 foot up.
8½ at 6 feet up.

No. 16. Locust planted in 1821, and standing within twelve feet of the two preceding trees.

Height, 19 feet 2 inches.

Inches round,
19 at the bottom.
16 at 1 foot up.
11 at 6 feet up.

Shoot of a Locust tree cut down in April last, 11 feet long. The tree was planted in 1821.

Four lateral Shoots of Locusts, from 7 feet to 9 feet 3 inches.

Planted in 1820 upon land spread with Flag Ashes.

Ash, height, 6 feet 11 inches, length of leading shoots, 2 feet.

Oak, height, 7 feet 3 inches, length of leading shoots, 2 feet 9 inches.

Planted in 1820, without any manure.

3 Ash, height, 5 3 inches, length of leading shoot, 0 feet, 9 inches.

Oak, height, 4 feet, length of leading shoot, 1 foot 1 inch.

Planted in 1820, on land which had been marled.

Ash, height, 9 feet, length of leading shoot, 1 foot.

Oak, height, 10 feet, length of leading shoot, 2 feet 6 inches.

Planted in 1824 upon land manured with 20 loads of muck, and 20 loads of marl per acre.

Ash, height, 6 feet 5 inches, length of leading shoot, 4 feet.

Ash, height, 6 feet 1 inch, length of leading shoot, 3 feet, 7 inches.

Oak, height, 6 feet 6 inches, length of leading shoot, 3 feet, 2 inches.

Oak, height, 6 feet, length of leading shoot, 4 feet.

Black Italian Poplar, 10 feet 5 inches, length of leading shoot, 3 feet 6 inches.

It will be seen that Mr. Withers is all along arguing the advantages to be gained by working and manuring lands before planting, over that planted in its original or natural state, and every one will allow that Mr. Withers is right; and every proprietor wishing to rear a group, cluster, belt, or clump of ornamental trees about his pleasure grounds, &c. would do well to attend to it, as no expense should, in cases of this kind, be spared to forward its growth. But in the Highlands of Scotland, and in Ireland, and indeed, I may safely say, in nineteen cases out of twenty, where extensive plantations are made for profit, it would be impossible and next to a prohibition. I may here again be permitted to say, that numerous proofs are not wanting, in a great many places in Scotland, where little soil is perceivable, and where manure, from the creation, till this hour, never was laid, growths of trees were made (from the first day of June to the first day of October the same year) from six to ten feet in height. Before dismissing Mr. Withers's interesting memoirs, the following paragraph is worthy of notice. "I assume," says Mr. Withers, as a fact proved by my own experience, that the difference in the growth of trees manured and not manured, very considerably exceeds six inches in a year. The trees in Mr. Coke's* one thousand acres of plantation may or may not have averaged in growth more than twelve inches yearly; but supposing they have not made more than twelve inches, when, if manured, they would have made eighteen, (and I am of opinion, that whatever their growth may have been, the difference would in proportion be equally great,) Mr. Coke's loss by not manuring his land will be far beyond the estimate I have made in the Memoir. His trees have, on an average, been planted nearly thirty-six years. Now, at the end of that period, it will appear by reference to Mr. Waistell's† tables, that if these trees had made twelve inches in height yearly, he might have cut 3036 feet of timber per acre, and have left standing 4250 feet; but if they had made eighteen inches per year, instead of twelve, he might have cut 10,855 feet of timber per acre, and have had now remaining 11,314 feet per acre. The extra produce of the 1000 acres would therefore have been 14,881,000 feet of timber, which at one shilling only per foot, (and the least valuable timber sells at a higher price) would amount to the enormous sum of L.744,050. Surely these calculations are worthy the consideration of those who, though regardless of their own emolument, (if any such there be) are yet desirous of finding profitable employment for the poor. Might not the public forests and the vast tracts of waste land throughout the kingdom, by the judicious application of the unemployed manual strength of the country, be made an inexhaustible source of national and individual wealth?"

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* Mr. Coke's one thousand acres referred to was neither prepared nor manured before planted.

† See Mr. Waistell's Tables in the Introduction as here referred to.

I shall only ask my readers' permission to make another extract from equally unexceptionable and respectable authority, Samuel Hayes, Esq. a landed proprietor in Ireland, from a small, but exceedingly useful Manual, said to be the third edition, published by him in 1812, and dedicated to the Right Honourable and Honourable the Dublin Society for the Improvement of Husbandry and other Useful Arts, entitled a Practical Treatise on Planting and the Management of Woods and Coppices. I have the satisfaction of saying, that Mr. Haynes agrees in many particulars with my own opinions, as published in my first edition in 1820. Mr. H. speaks for himself as follows:—

"An acre of coppice wood, from twenty to twenty-five years growth, in which there are no reserves from a past fall, may be worth £30.

"It will require twenty-four such trees as usually compose a coppice of that age, and which has not been regularly thinned, to produce to an average a barrel of bark of twelve stone, worth in summer 1798 fifteen shillings, which was then considered very dear. The poles of such a coppice sell from four to seven shillings per dozen.

"One tree of fifty years growth will produce a barrel of bark. The timber of such a tree is worth from twelve to twenty shillings. A tree of seventy-five years growth may be worth from four to seven pounds, according to its form and the demand for the particular timber it contains; the more crooked in general the more valuable.

"From hence we may fairly make the following calculation, viz. that an acre of coppice wood of twenty-five years growth, in which eighty of the best young oaks are now marked as reserves, and the remainder felled this year, will in twenty-five years (instead of thirty pounds, its utmost value at present,) be worth L.110 at least, after allowing

L.10 for the injury these reserves or overstands may do to some of the coppice wood.

"Now, supposing forty only of these reserves to be felled at the expiration of twenty-five years, and forty of the new growth to be then marked to supply their places, the value of the second fall, viz. in fifty years from this year, might be estimated as follows, at the lowest calculation:

"The Coppice Wood, ...	L.20	0	0
"Forty reserves of 50 years growth, at one guinea each, ...	45	10	0
"Forty ditto, of 75 years growth, five pounds each, at an average, ...	200	0	0
	L.265	10	0
"Add to the above the value of the first fall, deducting forty guineas for forty of the fifty years old reserves, which are supposed to be still left at this fall, ...	L.64	10	0
"The value of the acre in fifty years will then amount to	L.330	0	0

"And this great increase of the profit of our woods, obtained simply by the allowance of four pounds per acre at the first sale of the coppice, out of its present value, that being the average of what the wood buyer could demand for leaving eighty reserves on the acre, and often much more than he would charge, as he is thus saved the expense of manufacturing them. I well know that the lovers of money, which I am sorry to say is a term too often synonymous to the enemies of timber, will ask what might be made of four pounds put out to interest in fifty years. I will allow, for argument sake, though I am sure it is four times more than any of my brother planters or wood-owners have ever made or are likely to make of it, that by compound interest it may arrive to the enormous sum, in proportion, of L.128; but even that deducted from L.330, leaves a sum of L.202 net profit by the acre, and that gained not by incessant toil, anxious parsimony, and subject to perpetual risk, but with certainty, in a great measure without the least exertion, and I might say, without the necessity of even a thought on the subject, if not entered into for our own gratification and amusement, when we shall have the pleasure of finding, in this mode of managing our woods and coppices; and what in the end must prove a source of wealth to our family, contributes in the meantime to some of the most refined and rational enjoyments of life, whilst in the words of the truly pastoral Shenstone,

> 'We call forth refreshing shades and decorate repose.'

"Some years since the late Mr. Sisson, who was employed as a master builder under the surveyor-general of public works, having laid out considerable sums in the purchase of timber on the Shillela estate, was desired by the then agent to choose one tree for his own use, as a compliment to him for the preference he had given to those woods in the course of his employment. He made choice of an oak, which though forked from the ground, was of such dimensions that each stem was gross enough for a mill shaft, at more than fifty feet from the butt. Two pieces were appropriated to that use, the remainder he sawed into very thin panels, which sold from the saw, by measurement, for upwards of L.250. He might have taken a larger tree, but preferred this on account of the straightness of the stem, and clearness of the grain, from which circumstances, and its being forked from the ground, there is the utmost reason to believe that this great mass of timber proceeded from the root of a tree which had once been felled, though in all probability at no advanced age.

"I have the satisfaction of finding this statement of the great value of the tree felled by Mr. Sisson, supported by the accurate return of the produce of the Langleaf oak, on the verge of the new forest in Hampshire, with which Mr. T. South of Bassington has favoured the Bath Society.

"The tree was felled in the year 1758, its branches, which contained knees fit for a first rate ship, extended forty feet on every side, its trunk, which was about twenty feet high, measured twelve feet diameter at the ground, and six feet at the top; the contents of the whole amounted to thirty-two load of hewn timber, which, at half-a-crown per foot, produced precisely L.200. It is stated by Mr. South, that an oak of sixty years' growth, will in twenty-four years from that period, double its contents of timber, which I consider a very valuable piece of information.

"Mr. H. adds, the following are the measurement of five oaks taken from amongst numbers of the same age and dimensions, growing from the old stools of trees felled in one of my woods thirty-three years this May 1794.

	at one foot from the ground.	at five feet from the ground.
No. 1.	3 ft. 4 inch,	2 ft. 9 inch,
— 2.	3 ft. 4 inch,	3 ft.
— 3.	3 ft. 9 inch,	3 ft. 4 inch,
— 4.	4 feet,	3 ft. 7 inch,
— 5.	4 ft. 10 inch,	4 feet,

"Considerable as these dimensions must appear for their age to those who are apt to look on coppiced woods as little more than a collection of broomsticks, (which, in the way they are usually managed, I allow they but too much resemble,) I have reason to expect that their measurement at the expiration of the next five years will still more exceed the usual dimensions of trees of the same age, as there was not that attention paid to the wood for the first fifteen years after the fall, which I have since thought necessary and have so strongly recommended. These shoots but lately singled out are now beginning to show the great advantage of being allowed a sufficient space for their growth, and a free circulation of air, whilst the fine heads they are forming, and the smoothness and brightness of their bark prove what numbers may be thinned out of a coppice (if done gradually) without the least danger to the remainder from want of sufficient shelter."

The above fully and clearly substantiates my former assertion, that there is no method yet pointed out by which trees (say the oak, the Spanish chesnut, ash, elm, plane, alder, birch, all kinds of poplar and saugh) can be so securely and so speedily brought to be timber trees, or a plantation in whatever be the soil or situation, whether for ornament or profit, and also to shape them for any and every purpose, as that from cutting over, say natural growths, as will be seen by consulting the explanation of the figures on Plate 16, &c.

SECTION XXVIII.

OF MAKING ALLOWANCES FOR THE BARK WHEN MEASURING AND VALUING GROWING TREES.

When trees are old, with their bark on, it is common to make an allowance to the purchaser for the thickness of the bark; and the allowance to be made is supposed to reduce the tree to what it would be if the bark was stripped off. Various disputes have arisen of late years betwixt sellers and buyers as to the allowances for bark; and scarcely two measurers will, in measuring a quantity of round rough timber with the bark on it, come within 5 or 6 feet in 100 of each other. Hence it is become very common in many places for the buyer, when he makes the purchase, to make a clause in the agreement for the bark to be stripped off every piece where the girth is to be taken. It is true that the bark of all kinds of trees varies very considerably in thickness, according to age and size. If the following rule be attended to, it will be found to be very near the truth in all kinds of timber, beech excepted, which does not require so much allowance as the other kinds of hard wood, the bark being rather thinner.

From ¼ of the girth or side of the square,	To ¼ of the girth, or side of the square.	deduct	
From 3 inches	to 6 inches	½ inch	of the side or square.
6 do.	9 do.	¾ do.	
9 do.	12 do.	1 do.	
12 do.	18 do.	1¼ do.	
18 do.	and upwards.	1½ do.	

When the trees are measured growing with my newly invented machine, the extreme girth or circumferences of the tree are taken, from which deduct as follows:

When the girth or circumference is any thing.
From 12 inches up to 24 inches, deduct 2 inches.
From 24 inches up to 36 inches, deduct 3 inches.
From 36 inches up to 48 inches, deduct 4 inches.
From 48 inches up to 72 inches, deduct 5 inches.
From 72 inches and upwards, deduct 6 inches.

The above deductions will be found to answer in almost all trees, the same as if the bark were stripped off, unless in very old rough corky-barked trees, or when there is much moss growing on the bark. When the girth is taken in this case, it may require a little more allowance; but of this the practised measurer will easily judge. And let it be here ob- observed, that when trees are measured lying in the wood where they were cut, and if sold to be carted or shipped to any distance, the allowance should be made more fully, in order to make it stand out, than if the tree were lying where it was to be used; as by carting, &c. a little of the roughness is rubbed off the bark; and in many cases, when only one-eighth part of an inch of the extreme girth is lost, it takes one-fourth part of an inch of the side or square, when the girth is taken with a line.

For example, when the girth is taken with a line round the tree, the line is doubled, and applied to the foot rule; and the half of what the double line measures on the rule, is taken for the side of the square, which is one-fourth of the whole girth. And when the line is doubled, and applied to the foot rule, unless the line comes to an inch, or an inch or half an inch, should it only want one-sixteenth part of an inch of the double line, it is not counted, but thrown away: nothing but fourths of an inch being taken in this case, nearly three-eighths of an inch are thrown away of the double line, which is about three quarters of an inch often lost on the whole girth of line measure.—See this explained more particularly in measuring with the newly invented machine for measuring growing trees.

SECTION XXIX.

OF VALUING FULL GROWN OR MEASURABLE TREES.

The value of all kinds of trees, excepting those whose bark is used, and is of value as well as the timber, is easily ascertained by their measurement, which is taken in solid feet and inches, according to Hoppus, the standard measurer through Britain for all kinds of timber. Having taken the length and girth of a tree, or trees,—the way and manner of which is described in explaining the measuring machine,—and having brought the tree to solid feet and inches, and having also fixed on the price per solid foot, that such a tree, or number of trees, is worth, you will at once ascertain their value. But it requires a very different manner of calculation to ascertain the worth of those trees whose bark is of value.

Let us first begin with the oak tree, the bark of which is the most valuable. And here it may be proper to observe, that a great difference of opinion, as to the method of ascertaining the value of an oak tree, with its bark, exists, as every valuator has his own peculiar way of doing it. Hoppus, that excellent timber measurer, says that the value of the bark of each oak tree, generally holds to be about a third part of the value of the body and head. But it appears from this, that Mr. Hoppus had not been a practical measurer and valuator of oak trees with their bark; for this will not hold good in one tree out of a thousand.

For example, if we take hedge-row trees, or trees in very exposed situations, that are what is generally termed scraggy trees, such as have short trunks or bodies, and large spreading tops, without any measurable branches on them,—trees of this description will be found to have more value of bark, according to their solid measure, than a tree whose body or trunk runs up towards the very top of the tree, and has few or no branches on its top.

Suppose you have an oak tree on the outskirts of a plantation or a hedge-row, whose top has had abundance of room to spread. If its body or trunk measures nine feet long by nine inches, the fourth of the girth or side of the square, the trunk will measure five solid feet; and it having a very large top, but no measurable branches on it such as will stand six inches square,—which has been already observed is only reckoned measurable timber,—such a tree will contain ten stones of bark, which, at 2s. 3d. per stone, is L.1, 2s. 6d. for bark; and, reckoning the timber at 3s. per foot, it is only 15s. for timber. Here the bark of this tree is worth 7s. 6d. more than the measurable timber; and many such trees as this are to be met with.

But let us take another example. We have an oak tree, which measures twenty feet long in the body, and twelve inches on the side of the square; which makes twenty solid feet. And suppose there are as many branches on its top above six inches as measure ten solid feet, making in all thirty solid feet, then very few branches on this tree being fit for barking or being peeled, it will be found only to produce 22½ stones of bark; which, at 2s. 3d. is L.2, 10s. 7½d. Now, 30 feet of timber, at 3s. per foot, is L.4. 10s. Here the timber of the tree is L.1, 19s. 4½d. more in value than the bark. But, adding the value of the wood and the bark together, we find it L.7, 0s. 7½d. which makes the above tree to be worth, on an average, wood and bark included, 4s. 8¼d. per solid foot. Now, let us add the wood and bark of the first tree together, which make it L.1, 17s. 6d. which, including wood and bark, on an average, is 7s. 6d. per solid foot.

A great many, in valuing and measuring oak trees, go on the following data, that every oak tree will produce one stone of bark for every solid foot of timber; and a great many insist upon this holding good in every case; but the two examples, which are taken from actual measurement and weight, amongst many more that might be given, show the absurdity of this way of calculating, in which both the seller and buyer have been in many cases deceived—and more particularly, if the trees are sold by the foot while growing.

To give one striking example of this:—In the year 1806, I was called to superintend the cutting of 250 oaks, (all hedge-row trees,) which were purchased on an estate in Clackmannanshire, at 3s. per foot, bark included. When the trees were cut down, a sworn timber measurer, from the port of Alloa, was called to measure them, which he did accordingly, and made about 1000 feet in the whole. None of the timber of those trees being measured under 6 inches, of which a very great part consisted, and all of them having large tops, I weighed, from the above 250 trees, (measuring 1000 solid feet) 1865 stones of good dry bark, ready for and delivered to the tanner, which was very nearly two stones of bark for each foot of measurable timber.

Here it may be proper to observe, that some oak trees, though not so valuable for their timber, may be better worth 7s. 6d. per foot than others that have more valuable timber may be worth 4s. 6d. per foot.

From what has been already said, it will be easily seen, that, as trees are so various in the sizes of their tops, which is the great means of their producing less or more bark, according to their measurement, it is impossible to lay down a perfect rule for ascertaining it, without examining minutely the tree itself. A practised measurer, when he sees the tree, must judge of it accordingly; every tree, therefore, the bark of which is of value, particularly the oak, must be valued by itself.

After taking the measurement of the timber in solid feet and inches, set it down at what the timber of such a tree is worth per foot; then calculate on the quantity of bark, in stones and lbs. that such a tree, according to the quantity of small timber that is not measured on it, will produce of bark, and set down the price per stone that it will sell at; then add the two together, and you will obtain the gross value of the tree. This is certainly the surest way of valuing large trees. The method of measuring small trees is explained in Section XXVII.

In valuing coppice trees, let it be carefully observed that the bark of trees, as already explained, will vary considerably in weight, according not only to the size of the tree, but also to the coarseness or fineness of the quality of the bark.—The following observations, taken from actual measurement and weight, may assist a young beginner, in ascertaining the quantity of bark from various trees. An oak tree, about forty years old, measured down to 4½ inches, side of the square, and weighing only the bark peeled off the timber that is measured, without including any of the bark of the crops, &c. every foot of measured timber will produce from nine to eleven lbs. of bark. An oak tree, of eighty years old, weighing only the bark peeled off the measurable timber as above, every foot will produce from 10 lbs. to 13 lbs. of bark. Every foot of large birch timber peeled as above, will produce 14 lbs. of bark. Every foot of rowan tree as above, will produce 11½ lbs. of bark. Every foot of the willow, unless a very old tree, will produce from 9 to 11 lbs. of bark. Every foot of larch fir, not exceeding thirty years old, will produce from 7 to 9 lbs. of bark.

The timber of trees, particularly the oak, is peeled out, every crop or branch, down as small as an inch in circumference; and, as was said before, according to the quantity of branches, or measurable wood on a tree, so will be the quantity of bark.

SECTION XXX.

OF CUTTING DOWN LARGE TREES.

When trees are to be thinned out of a plantation, and when the remaining trees are to be nursed up to maturity, or even when large trees are cut out from among young coppice wood, the greatest care ought to be taken not to hurt the trees remaining. For this purpose, the trees to be cut ought to be lightened in the top as much as possible, by cutting off a number of the top branches, and particularly those that hang most over the trees which are to stand. This is done by a person going up the tree with a ladder, and, with a hand-saw, cutting off the impending branches. But this is both a tedious and very dangerous operation, and might be more safely and speedily done by fixing a hand-saw to the end of the connecting rods for working the measuring machine: by having a hand the same as that of a saw on the end of one of the rods, and by giving the saw a little extra setting, a person may stand on the ground and cut off a branch of any size or height from a tree with ease and safety. A few rods (a little stronger than those used for the measuring machine, with the connecting screws a little larger, say about 1¼ inch diameter, with a thin plate of iron on the end of one of the rods, to screw it to the hand-saw,) kept for this purpose, would be of great use in pruning trees, and would be attended with many advantages. In cutting large trees, that stand nearly perpendicular, in order to make the tree fall by the way required, enter the cross-cut saw on that side of the tree it is intended to fall, and cut it about a third part through; then enter the saw at the other side, and when it is cut so far as to admit a wedge, place the wedge exactly opposite the way you want the tree to fall, and keep driving it slowly till the tree is nearly cut through. Be sure the saw meets the opposite cut equally on both sides; and do not imagine, as some have done, that, by making the saw meet sooner through the one side than the other, the tree will fall to the side soonest met or first cut through: on the contrary, the side of the tree longest in being cut is that side to which the tree will naturally fall, and by keeping a little of the wood not cut quite through on the side you want the tree to fall to, it will greatly assist in bringing the tree to fall that way.

By attending to the above hints, it will be found very easy to make a tree fall any way; but if the tree has a heavy top, or if it inclines very much to that side on which it is not intended to fall, it will be necessary to make use of a rope. For this purpose, the connecting rods will be found very advantageous, by having a hook at the end of one of them, so that the rods may carry up the rope, and fix it on the top of the tree, without the very dangerous and laborious work of a person going up the tree to fix it.

SECTION XXXI.

OF BARKING OAK WOOD, AND PREPARING THE BARK FOR THE TANNER.

THE time to commence the barking or the peeling of all kinds of wood has already been pointed out in Section IX. of this work. All that I intend here, is to describe the manner of peeling, and otherwise manufacturing the bark. With this view we shall suppose that the forester is about to commence the operation of barking, and that he has engaged a proper number of the best instructed men and women that can be had for barkers, according to the extent of his undertaking. The barkers are each furnished with light short handled mallets, made of hard wood, about eight or nine inches long, three inches square at the face, and the other end sharpened like a wedge, in order the more easily to make an incision in the bark, which is done all along the side of the tree which happens to be uppermost in a straight line; and as two barkers are generally employed at one tree, or large piece of timber, it is proper that whilst the one is employed in making an incision with the mallet as above, the other be furnished with a sharp instrument, called a bill, or *whittle*, resembling a hedge bill, with which the bark ought to be cut across the tree, in lengths of from 2 feet 6 inches to three feet. Having thus made the incision in the bark both ways, the barkers being also each furnished with what is called peeling irons, an instrument made of iron about six inches long, 1¼ inch broad in the face, sharpened like a wright's chissel, a little bent in the broad way, the more effectually to go round the tree, having a handle of wood about 4 inches long; if the tree, or piece of timber to be barked, is such that the two barkers can easily lift one end of it, this is placed on two pieces of wood, 3 feet long, and called horses, these are about the thickness of a paling stob, and have a forked end on each about 6 inches long, the other end sharpened to go into the ground. Two of these horses are placed in a triangular form against each other, one end of the piece to be peeled being raised on the horses, the two barkers standing opposite to each other, and entering the peeling iron into the incision made by the mallet, and pressing the iron downwards between the bark and the timber. In this way it will be found very easy to take the bark off in one whole piece, as long as the incisions made in the bark. In some cases where there is not much sap, the bark may require a little beating with the square end of the mallet, to cause it to separate easily from the wood; but the less beating with the mallet the better, as it has a tendency to blacken the bark in the inside, or fleshy part of it, so that when the tanner sees it, he supposes it to be damaged, and undervalues it. The branches of the tree being previously all lopped off with the axe, the persons, in number according to the extent of the work, with a bill or whittle smooth all the branches, cutting them in lengths of from two feet six inches to three feet, down as small as one inch in circumference. The barkers, principally women, are each provided with a smooth whinstone about six or eight pounds weight, beside which they sit down, and, having collected a quantity of saplings, branches, or twigs, they hold it on the stone with the one hand, and, with the mallet in the other, they beat the piece till the bark be split from the wood from the one end to the other, and taking it off all the length of the piece if possible, then lay it regularly aside till a bundle of considerable size is formed.

The point most particularly to be observed in this art is, putting the bark up to dry; which is done by putting the bark upon what is called the lofts or ranges. These are erected by taking forked pieces of the loppings called horses, the one three feet long, the other two feet six inches, and driving each about four inches into the ground, opposite one another, about two feet asunder in the breadth, and as much betwixt them, lengthwise, as will admit long small pieces of wood to be put upon them, and as many of these must be put together as will hold the bark of every day's peeling. These ought to be erected in as dry and elevated a spot as can be found in the wood. The bark being carried and laid on this loft, with the thick ends of it all laid to the high side of the range, and the small bark laid on to the thickness of about six inches; and the bark taken off the largest of the wood laid regularly on the top, which serves for a covering, and the lofts or ranges having a declivity of about six inches, the rain will run off them readily, and if properly put up in this manner, they will keep out a great deal of rain. After it has lain in this state for four days, if the weather is good and dry, it ought to be all turned over, and the small bark spread out, so as not to allow it to stick together: which, if much pressed, it is apt to do; and if it does so with the natural sap in it, it has a chance of moulding, which is extremely hurtful to the bark, and both lessens it in weight and in value. After the bark has stood on the ranges about eight or ten days, if the weather be good, it may either be put into a house or a shed; or if intended to be put up into a stack, it may now be done. A stack of bark ought never to exceed eight feet in width, and twelve or fifteen feet in height, raised in the middle like a hay stack; and if it is intended to stand any time, it ought to be carried beyond the newly cut wood, or hag, and put up in as airy a place as possible; and on no account whatever ought the bark to be stacked above any of the newly cut oak stools. If it is to stand any length of time in the stack, it ought to be thatched either with straw, bog-reed, long heath, or broom; and if in good order when put into the stack, it may remain in it, if necessary, all winter; but if it be so intended, it must be removed beyond the newly cut hag altogether. The greatest care ought to be taken to preserve the colour of the inner parts of the bark, because the colour of it is generally looked to as a principal criterion of its value; and the merchant or tanner judges of its value chiefly by its colour. Before being put into the stack, the natural sap ought to be dried out of it, in order to prevent its fermenting; because, if a fermentation takes place in one part of the stack, it generally goes through and spoils the whole.

The same mode of treatment will do for all kinds of bark as well as the oak; but the birch, the larch, and the willow, will peel in April.

In barking the birch, there is an outer or shreddy skin upon it, which is of no use and rejected by the tanner, and must be peeled off. This used to be done at such an expense as almost over-balanced the price of the bark. Within these twelve months I have found out a method of doing it most effectually and cheaply; which is this: In spring, say early in March, make a longitudinal incision in the bark, to the deepness of the wood of the tree, or trees, to be cut and barked in the following summer. This being done, when the sap ascends the tree it will throw off the shreddy skin, so as it can be taken hold of with the hand, and pulled off in one piece round the tree. If the trees are very large, it will be necessary to make an incision on two sides of the tree, in opposite directions. The incision can be easily made by fixing the cutter of a wood marking iron to the end of a small rod; the connecting rods for the measuring machine will be found very useful for this purpose. When the bark is ready for the tanner, it has to undergo the work of chopping, which is done by driving in two or more stobs into the ground, with a fork on the upper end of each, leaving them about two feet six inches from the ground, and laying a long round piece of wood across between the two, where a number of people stand, and the bark is carried and laid down behind them, which they take up in their hands, and lay on the cross tree; and then, with a sharp whittle or bill in the other hand, they cut it into small pieces, about three inches in length: when this is done, it is trampled into bags which hold about two cwts. each, and in these bags it is weighed when sold by the ton, in tons, cwts. quarters, and pounds, English weight; and when sold by the stone it is generally weighed with Dutch weight, and in the above manner delivered to the merchant or tanner. Formerly it was a custom to sell bark by the boll; and in some places of the Highlands it is still practised, and sold at ten Dutch stones per boll.

SECTION XXXII.

TRANSPLANTING LARGE OLD TREES.

THERE may oftentimes be occasion for removing trees of a large size and growth, either to ornament a newly made place, or to supply the place of some large favourite tree, that by stress of weather, or some unforeseen accident, has been destroyed, or that may have fallen a prey to the ravages of time. To supply the place of such a tree with somewhat of a corresponding object to the one now gone, is of the greatest importance. Allow me here to observe, that although a tree of any weight and size may be removed and transplanted by the machinery, as shown in the plates and figures for that purpose, yet this can only be done with safety for their future prosperity with a healthy, thriving, growing, tree, and not yet arrived at its full growth. If this is carefully attended to, by the following method there is no doubt of success. Here, however, the greatest caution is necessary to be used, to prevent the loss of the tree, which naturally would, and does often, happen when such transplantations are set about rashly, and without the necessary care. When there is occasion then to remove a very large tree, the method to be taken is this: A year at least, and if allowed two, so much the better, before the tree is removed, let the earth be opened at from five to six feet from the trunk of the tree, (that is to say, not to touch the roots nearer the tree,) in form of a trench; dig this pretty deep under the horizontal roots, so as to leave a ball of earth about the stump of from six to eight feet (less or more, when the trees are very small or very large,) in diameter. When this trench is dug to the needful depth all round, and the side roots at that depth are all cut through, if it be found that the tree has a perpendicular root, as many trees have, it will be necessary to apply a rope to the top, or nearly so, of the tree, and place the portable machine, (see the plate,) which we may call a winch or crane, at a proper distance, and put the rope round the roller; and two men turning the wheel, one at each side of the winch, will easily bring over the tree, so that a person with an axe may cut through the perpendicular downright, or what is called the top root, and having done so, allow the tree to return back to its former situation. Having done this, let the earth that was dug out of the trench be thrown in again. If the tree is in an exposed situation, and supposed to be in danger of being blown down with the wind, it will be necessary to fix two more ropes to its top, and drive in three stakes at some distance in the ground in three opposite directions; and drawing the ropes tightly, which may easily be done with a few turns of the winch, and fastening these ropes to the stakes, the tree will be able to resist with safety the most furious winds. In this manner the tree must be allowed to stand one year, and if two so much the better, the more sure will be its growth when removed; and, if time would permit, it would be much the better for standing three seasons in the above prepared state before being removed. But a good deal as to this depends upon the tree itself. If a young healthy tree, say from 20 to 30 years of age, one season will do, but if an older and larger tree it will require more. Observe that this operation must be performed very early in spring, on or before the 1st of February; and the trees should be removed, and put into the place where they are to stand, on or before the 1st of March. But I would much rather advise them to be removed in the end of November or in December, immediately after they have thrown off their foliage; as, if it is an open winter, the roots will begin to strike very early, and this gives them every opportunity of vegetation. It may be said, the winter gales will be against them; but I would here advise that the same method in fixing them, where they are to remain, be taken as in taking them out, say by three ropes from the top, which may remain for three or four years, as need may require, according to the size of the tree. This will be found a much more safe and effectual method than fixing them by poles to the trunk of the tree, as these generally hurt the bark of the tree; nor do they properly keep the tree from shaking with the wind, which retards its growth when the tree is set up into its place. When planted, it should be placed upon a quantity of fine mould, and a large quantity of the same, mixed with a little cow-dung, for filling up the holes upon the top and at the extremity of the roots, beaten up with a sufficient quantity of water, to reduce it to a kind of paste. A small sprinkling of lime may be added, which will keep away vermin from destroying the young tender fibres of the roots. When this is done, and the holes properly filled up, cover over the whole with turf, and lay a quantity of stones above the roots of the trunk, which will keep the ground moist, and help to preserve the tree steady. Be careful also to place the tree in the same direction to the sun as it stood when it was reared, that is to say, place the same side of the tree towards the south that stood to the southwards when it was reared. This can be easily done, by placing the removing machine or carriage in the very same direction that it was placed in to receive the tree, as the tree is taken down with and upon the machine, and carried to its place, and put up with it, before being disengaged from the carriage.

For a more full account of the transplanting of large grown trees, see the explanation of the plates.

By another mode, we may have a whole wood scenery on the most bare, bleak, and barren soil imaginable, in one season, and this too either for underwood, shelter for game, screen, cover, or to hide from the sight any bare rock, or any unsightly place, from the view from a mansion, or such like. Take healthy oaks, Spanish chesnut, ash, elm, lime, plane, poplar, saugh, birch, or any tree that grows naturally from the root or stool, let them be of the size of a tree at least six inches in diameter, or as large as full-grown trees if you choose, but stools or roots from six to ten inches are most conveniently removed; let these be cut over, and properly dressed up for the growth, as laid down in the section for cutting and dressing coppice woods, and remove their roots, with as much of their natural earth as can be conveniently got with them, and put them down where you wish the tree or underwood to be reared, and in one year you have growths from three to six feet; and if you want timber trees, thin out the stools or growths for that purpose into two or three stems, and you will have good trees, twelve feet or more high, in two or three years; and if you want underwood, allow the whole of the saplings to grow. By this method the barest rocks, if there is the least crevice for the roots to get into, and the barest land and most exposed situation, may be securely planted and covered with trees at once. The roots from a newly cut coppice answer this purpose excellently well. These roots may also be removed after the shoots or growths are two or three years old, if the situation they are to be placed in is naturally bare and exposed. A dark avenue, or wilderness walk, may be at once made by planting the common or American spruce firs by the sides of the walks, or anywhere else where a dark screen is wanted. Take spruce firs from ten to fifteen feet high; take them carefully out by the roots, carefully preserving their small young roots at all their length: dig a proper pit to receive the one side of the roots, laying the tree down on its broadside longitudinally on the ground the way you want the cover, put the best and most promising sided roots into the pit, carefully spreading them, and cover them carefully over with good rich mould or earth, either from the pit, or, if the soil is bad, carry richer soil to it, likewise bind down the roots from the upper side of the old root, and cover the whole over with the earth, layering in some two or three of the branches near the top into the ground, as directed in the section on layering. If this is properly attended to, the top shoot, and the whole side shoots will, in two or three years, send up most beautiful pyramidal trees, and particularly the top shoot; in this way a complete fence or thicket will be obtained in two or three years. The spruce or silver firs may be layered down in this way with more success, where it was reared, after it is a large tree, by cutting the roots only on the one side, and forcing it down, &c. laying it on the side the roots are left firm, and covering up the other roots as aforesaid. I have often laid down whole trees of a large size of these kinds in this way. By planting the trees in at proper distances when they are to be laid down, and allow them to grow to the proper height before laying down, will insure success, and will make a hedge, not only so close as to keep out cattle and sheep, but to resist the rays of the sun. By taking out the roots of trees dressed up for the growth, and planting them when new cut over, is the surest, speediest, safest, and least expensive way of obtaining a plantation of timber trees or underwood in a short time, or giving immediate effect to it as a wood plantation, or even a single tree. If the roots are healthy, and taken from a poor soil and put into a rich soil, the progress of the growths will be most astonishing. I have seen some individual growths fifteen feet high in two years.

To plant and furnish a lawn, park, field, or pleasure grounds to any extent with ornamental trees, from one to hundreds of acres, the following plan, for instance, will be expeditious, sure, speedy, and done at little or no expense. Forty trees will be quite sufficient for each imperial acre, supposing them placed at regular distances; if in groups, it may require a few more, suppose 40 plants to the acre, which, from the nursery, will cost, of the best plants, 2s. or not exceeding that price for all kinds; these to be inclosed singly with stobs and the warpings of larch fir, as recommended elsewhere, which will not cost 10s. more of workmanship, for inclosing these 40 trees. Thus the plants, planting and inclosing one hundred acres, will not cost more than sixty pounds sterling. There also may be large transplantings of trees or roots, as aforesaid, in order to give immediate effect to it as a wood scenery. Should the above manner of inclosing them in such pleasure grounds be prejudicial to the eye of taste, they may be securely, cheaply, and yet beautifully inclosed by my portable paling, which will always have a light and neat appearance, and by no means be offensive to the eye. The inclosing, in whatever way it be done, only requires to stand for a few years; in the case of transplanting roots, two or three years at most, unless in sheep-walks, where it will require a few years longer. Here we may have one hundred acres completely furnished with ornamental trees for sixty pounds.

SECTION XXXIII.

OF THE DISEASES OF TREES.

As in the animate creation, so it is in the inanimate, which may also be said to possess life, and is subject to diseases. Still confining myself to the forest, it is only the diseases to which forest trees are subject that I shall for the present take notice of.

When the top of a tree begins to decay, it is to be suspected that there are faults in its body: when in any tree there is a swelling vein perceived rising above the level of the rest of the tree, and covered by the bark, it is a sure sign that all is not well within; more particularly when this vein twists about in the manner of ivy, it is the worst sign of all, and seldom or never is seen but when the tree is otherwise faulty. All such trees will be found more or less shaken in the heart, as it is generally termed, that is, the tree will be all in splinters. This is particularly the case with both Scotch and English elms. Nothing is more detrimental to the value of trees; for timber, when splintery, it is equally bad as when rotten in the heart, as it will cut up for no purpose whatever; nor is a splintery tree fit to be used in one lump, particularly in any part of ship-building. A tree may often have blemishes in the outside, which is often the effect of injudicious pruning; yet it may be sound in the heart, excepting where the branch has been lopped off, which always leaves a blemish if the branch has been of any size at the time; and if the tree stands long after it has been taken off, and if the part where the branch was lopped off is not carefully covered up, it often rots the main trunk of the tree. If a tree shows symptoms of decay in the top, without any apparent cause, a very good method to ascertain from what cause, is to open the earth about the roots, and carefully examine in what condition they appear. If they are fresh, sound, and full of juice, it is a sign all is well about the root; and very likely all will be well also with the main trunk of the tree, and the symptoms of decay in the top must proceed from some other cause: but, on the contrary, when many of the roots are found in a decayed state, without any visible cause in the ground, or when some of the roots are rotten, brittle, and mouldy, there is something wrong with the root; and the decay of the top proceeding from this cause, it may with good reason be suspected that all is not well with the main trunk of the tree. I believe very few have made a point of examining the roots of a tree to ascertain the causes of its decay, although in one case out of ten the cause will proceed from the root. Often when I proposed to examine the root, it was counted foolishness, and a chimera of my own; but although this is said to be a new way to discover the state of a decaying tree, and has not been attended to, I will aver, whether it be counted chimerical in me or not, that a decay here in the root is a more fatal sign of the total decay of the whole tree, than the deadness of any part of the head of it. Trees may be, and oftentimes are, blighted, or, what is more generally termed, frost-bitten; or I would suppose it frequently the effects of lightning; but in the most of these cases, when only affected in the top, it only stops the growth for one or two seasons, and they again recover, excepting when the trunk of the tree is struck by lightning, so as to splinter the timber and separate the bark from the tree, which often happens, and in such cases the tree is altogether destroyed. Severe dry frosts are often fatal to trees even of a large size, and oftentimes rend the trunks in a manner similar to thunder, and kill the tree.

A very particular instance of this happened some years ago to a large old ash tree on the estate of Carstairs, the property of Henry Monteith, Esq. M.P. Mr. Loudon, the gardener, chanced to be passing the tree in the time of a severe frost, when he heard a crackling noise, the same as if a large piece of timber was rending in pieces by the force of axe and wedges. On stopping and turning to the tree from which he supposed the sound to arise, he perceived, on looking into the trunk of the tree, (which was between two and three feet in diameter,) a longitudinal incision or rent from the root to the top of the trunk, so as to admit of his hand going into the heart of the tree on one side. The tree was perfectly sound before, but will always bear the marks of it, although still thriving. Many more instances of a similar nature could be given of such effects of severe frosts on healthy growing trees. A great many of the blemishes formerly mentioned in the elms, &c. are the effects of frost. It may be worthy of observation here, that upon those trees that are most vigorous in growth and full of sap, the frost is most severe, and particularly if the frost happens to be late in spring, after the juices begin to ascend and flow freely through the tree. At this time and season its effects are most severely felt after a fall of rain. The effects of frost are also felt on timber in the log. This is well known to the sawers of wood. Thus if the log is green, with the natural sap in it, or socked with wet, in a severe frost the log is very brittle, and the saws will with difficulty cut it. Insects very frequently occasion a very serious disease in trees of all kinds, but particularly in the larch and common Scotch fir. These in prodigious numbers attack the larch fir at first on the extreme points of its branches, and soon overrun not only the whole tree, but often a whole plantation. They present a downy white colour, like hoar frost. When squeezed in the hand they fill it with blood, and make the fingers stick together like glue, which may be occasioned by their emitting and living on the rosin of the tree. Insects attack the Scotch fir, by piercing through the bark into the timber, which is discernible by the tree emitting the rosin sometimes in hundreds of places on the trunk of the tree, in form of white drops, like small beads. At each of these places there is a small hole, fit only to admit the point of a pin, in which is the insect. So soon as these spots are perceived in a fir tree, it never lives above one year after; and as soon as the tree first attacked dies, they seize upon another healthy one, and so on till they have been known to kill a whole plantation. Moss, or what is commonly called fog, is very injurious to trees of all kinds, which is the effect of damp, from want of draining, thickness, or closeness of the trees upon the ground, and allowing a poisonous kind of grass to accumulate among the roots. Moss is also often occasioned by injudicious pruning, when the root of the branch is not properly dressed, but allowed to rot, from whence moss grows, and harbours insects, which overrun the top of the tree, and kill it when the root is clear. Canker is a disease incident to trees; but this is most commonly occasioned by external injury done the branches by friction on each other, cattle biting off the bark, sheep rubbing on the trunk of the tree, or some of the causes already mentioned.

MEANS OF CURE OF THE DISEASES IN TREES.

Fault in the Roots.

This may be occasioned by a sudden transition from dry to wet, or from wet to dry: extremes in either case should be avoided. I have known a row of trees, chiefly oaks, almost killed, by opening a ditch within about eight feet of them to drain the ground. The first year after the ditch was cut the trees all died; many of them scarcely put forth a green bud. The second year they were much worse, not a living tree. The proprietor began to despair of their recovery, and wished them sold, although with reluctance, as they were, from the situation they occupied, very ornamental. I requested of him to let them stand for another year, I having in autumn, the second year after the ditch was cast, dug amongst the roots by the sides of the ditch. I observed new small fibres striking downwards in search of new ground. The third year some of them put forth a few scanty buds; the fourth year the whole of them put forth a few buds; and the fifth year all of them were again in full blossom. This plainly showed me that the roots of trees extend a great way under ground, and will push and find their way to good soil if there is any near them, as the roots of these trees are now crossing the ditch below, and rising up on the other side. When the disease of a tree is found to be in its roots, I have found it of the greatest service, and have often recovered dead trees, by carefully cleaning away all sour moss or fog from the surface, and also paring away all the rotten roots, and adding some fresh earth with a sprinkling of lime. I have also, when the tree was totally dead, and the cause proceeding from the roots, recovered them, by throwing a few of the surface roots open, paring a little of the bark off the top of the roots with a very sharp adz, and allowing these to stand exposed to the sun for a season, say from April, when it should be done, till September, taking care not to interfere with the earth below the roots; and if there is the least sap in the roots, or if not totally decayed, they will send out new fibres by, and often before the month of September, when they should be covered with fresh earth, and the while covered over with a white clover turf, not exceeding two years old—the turf not less than three inches thick, which will keep the roots warm and moist, and encourage vegetation. By this method I have often recovered dead trees when the disease proceeded from the roots. This would be very serviceable in fruit trees.

Blight on Trees.

This, as I said before, is often the effects of lightning and frost, and takes effect most commonly after the blade is out, and kills the growth of the tree for a season. I have often recovered the year's growth, although it kept it late, by paring off the bud with a sharp knife, and cutting off the top shoot by the next eye in young trees or plants. But this would be far too laborious a task for the forest. Gardeners may take the hint for the orchard. Frosts, as I said before, are injurious to trees; and here I would particularly caution the forester not to prune any in time of frost. Although dry frost is a season favourable for working in the forest in winter, yet pruning of no kind should be done in frost, even admitting the branch to be pruned off should not be half an inch in diameter; but particularly so when the branch is of considerable size, as it affords an opportunity for the frost to penetrate into the heart of the plant or tree, and is more or less injurious to the timber, or growth of the tree. Here, by the way, it may be proper to notice the time most proper for pruning forest trees. All kinds of hard wood trees should be pruned in the months of March, April, and May, after the most of the severe frosts may be supposed to be past: say the plane, lime, poplar, and all kinds of willows, early in March; and the oak, Spanish chesnut, elm, beech, ash, hornbeam, and maple, from the first of April, and before the end of May, or middle of June at latest. Let it be here observed that the pruning I mean, at this time, is, when it is necessary, to take a branch off any of these larger than two inches in diameter at the bole of the tree; and when such a pruning or amputation of a large branch becomes necessary, it should always be done in the above months, and that too in a dry day; and, before getting wet, the wound covered over with the balsam, as recommended in the cure of canker, &c.

Insects.

The insects, as before mentioned, that attack the larch fir in such vast numbers, are most frequently to be found in plantations that are allowed to remain very thick, and which is too frequently the case with larch fir plantations; it being foolishly imagined that larch fir trees will not come to perfection or maturity, unless allowed to remain at six or eight feet distance tree from tree. As I said in the section on thinning, the larch firs will do closer than almost any other tree; still, as they grow to a very large size, they require a very considerable degree of room: and although these insects attack sometimes a single larch fir tree, the only remedy I have ever found for preventing them from overrunning a whole plantation, is to thin them out early to the distances they should stand to be reared to maturity, as directed in thinning larch plantations, so that a free circulation of air may be admitted through the plantation. Boil salt water, or add a large quantity of salt to fresh water, where salt water cannot be got; put it on hot lime shells when boiling, in an open cask, or some other vessel; cover it up for twelve hours, then mix it well, and allow it to shire; take off the water in a common watering-pan, and water the trees whereon the insects are; this will be found to kill them, and to prevent their return for two or three seasons, and often for ever after, if the whole trees have been watered. When insects attack the black, or Scotch fir, in the manner as aforesaid, the only way to prevent their ravages, and save the tree, is to scrape off the outer bark wherever they are seen to make their appearance, and lay that part of the tree over with the balsam, which will completely prevent them from spreading over and killing the tree. This, however, would be both an expensive and laborious work for the forest, but may be easily done to save and preserve a favourite tree. But when the tree is attacked in the forest, and when it can at all be spared, to prevent its infecting other trees, it should be immediately cut down and taken out of the wood. Moss often harbours insects; and whenever it is seen to grow on, or begin to cover a tree, either about the root or amongst the branches, it should be scraped off; which is very easily done by fixing a scraper to the end of a rod, which may be made to any length by the connecting rods, and the moss scraped off either the trunk of the tree or its branches; which could be done by women or boys at a very trifling expense, scarcely worth naming, when it is taken in time, and which will often save the life of a tree, at least greatly facilitate its growth.

Canker Wounds, and Bruises.

From whatever causes these may proceed, wherever the tree is barked, and the timber not injured, pare carefully off, all round the place wounded, the loose parts of bark close into the wood of the tree; then paint the wounded place over with the balsam prepared as afterwards described, extending it about one inch over the adjacent parts of the bark. If a branch is broken off by the wind or otherwise, when the timber of the tree is much injured, let the loose splinters and particles be properly dressed and cleaned out, even allowing it should go into the heart of the trunk; always sloping it downwards, so as not to lodge water, and taking off all the loose bark as aforesaid, then laying it over with the balsam, taking care that the place dressed up be properly dry when it is laid on. Or when it becomes necessary to take a large branch off a tree, let the place where it is taken off be properly dressed up, close to the trunk, as described in the section on pruning, &c. and then lay it over with the balsam. By attending to the above directions, this balsam will not only prevent the tree from dying, when much injured, but will have a tendency to draw the new bark very rapidly over the places injured.

By carefully attending to the dressing up of the wounds, as aforesaid, and timely applying the balsam, I have no hesitation to aver that the lives of many valuable trees may not only be preserved to maturity, but also their timber, when cut down, rendered much more valuable.

Preparation of the Balsam.

This balsam is prepared in the following manner:—Take of the liquid extracted from the oak timber,* one gallon, one English pound of salt; boil it till the salt is all dissolved;† pour it upon new burnt lime shell till it falls into dust; put the lime through a very small wire riddle; mix it up with whale oil in the manner of paint, keeping it considerably thicker than common paint; and to give it the colour of the bark of the tree, add a little lamp-black or charcoal dust, and then apply it to the wounded parts of the tree with a painter's brush, in the same way as painting, laying it on when the wood is dry, and in a dry day, so as it may harden before the rain washes it off. This may be repeated yearly, till the wound is healed up. When salt water can be got, half the quantity of salt will do for each gallon. By the early application of the above balsam on a wounded place of a tree, or even where a large trunk has been amputated, it will be found to draw the bark very speedily over it; so much so, that I have seen it the means of drawing the bark over a wound four inches in diameter in one season; and it will be found completely to keep away vermin and insects from the wounded parts, and prevent the rot from spreading, even where it has begun its ravages, and will

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[*] For the manner of extracting the liquid, see the figure in the plate.

[†] Larger quantities may be made when required, but abide by the same proportions.

prevent the sun, the rain, and the frost, from being injurious to the wounded parts, and will completely cure what is called canker bites of cattle, and all kinds of vermin, &c. in trees. I do not wish to be understood as to go the length of asserting, (with Mr. Lyon,) that, if trees are wholly deprived of their bark, this balsam, or any other composition whatever, will keep them alive and make them grow; but thirty years' experience has taught me, that the above composition or balsam will heal the wounds, facilitate the growth, and preserve the life of a tree better than any other thing that has been suggested by any author that I have had it in my power to consult; and those who try the aforesaid balsam will very soon experience its healing effects.

Mr. Lyon proposes the following query as to barking trees:

"*Query*, May not forest trees be peeled with advantage, especially the oak, whose bark is so valuable in manufacture, and whose wood, to the wealth and defence of the nation? but which last is lost, being cruelly cut down for the sake of its bark before it is fit for this service. I had no forest trees to practise upon; but I have as little doubt of the result, as I had of that of fruit-trees, which will be not only to preserve the oak till it is fit for ship-building, but likewise increase the quantity of both wood and bark; for both increase in proportion to the circumference of the tree. The annual layers of wood and bark are, we believe, *cæteris paribus*, equal in thickness. Therefore a tree of four feet circumference will make double the quantity of wood and bark in one year, with one or two feet circumference: but the increase will be still greater; for, when the stricture of the bark is taken off, the tree grows faster.

"Since I first published my observations on fruit-trees, I have been at some pains in examining the bark of the oak; and find that the tanning principle resides in every part of the bark, when fresh, except the inmost, which is left for the support and growth of the tree. It is likewise to be observed, that the oak ruptures the bark, and attempts an exfoliation, very early by nature; that these half exfoliated flakes lose all the tannin, and are good for nothing in the manufacture of leather; so that, in peeling the oak, there is both a gain and a saving.

"I know an objection has been stated against peeling the oak, that the wood growing faster will be less hard and durable. We believe the reverse will be the case: for when the thick rigid bark is taken off, the sap will be more exposed to the influence of the atmosphere,—the agent which converts the sap into wood. And it will be found, that if a tree is either peeled or barked, long before it is cut down, the wood will be specifically heavier,

SECTION XXXIV.

OF PREVENTION AND CURE OF DRY ROT IN ALL KINDS OF TIMBER.

In entering upon this most destructive malady, it will be found interesting to the reader to lay before him a copy of the following letters on the subject, which appeared in the Stirling Journal in 1821 and 1822, when the disease made its appearance in the timber of the New Church of Alloa, (then only two years old,) as also in many other houses.

LETTER I.

Sir,

A disease in wood, under that name (though scarcely applicable), and of the most virulent nature, has made its appearance in Scotland only within the last few years; but where this plague has shown itself, its ravages have been no less extensive than hurried in its operations. As this disease is little known in regard to its cause, commencement, progress, or cure, I have thought of communicating its existence in our neighbourhood, through the medium of your paper, more with the hope of calling the attention of your readers to a minute investigation of the subject, than from my being able to narrate any thing new from my own observations. For some time past, its progress has been productive of considerable trouble and expense in several dwelling-houses here, where the ground-flooring of some of them has been three times removed, and several experimental antidotes resorted to, but as yet without any proof of a permanent cure. Lately some slight appearances of this malady were observed on the ground-floor of the elegant new church of Alloa, which created a suspicion of its having begun there; and on raising some of the boards, sufficient proofs were found of its actual existence and infectious disposition. A meeting of the heritors has just been held, and the promptest measures, suggested by the architect of the church, Mr. Gillespie, entered into, to prevent its extension beyond the ground-floor.

I believe it has been sufficiently ascertained that the rudiments of the disease exist in the timber when brought home in logs, its development commencing often afterwards in house-flooring, in the appearance of a whitish powder scattered over the adjacent parts, and afterwards springing up in a mushroom-like excrescence; and when this goes on without any check, we have had ample proof in our neighbourhood of its having wasted a piece of ground-flooring in a very few months. Perhaps some ingenious correspondent, who has had an opportunity of attending to the progress of the dry rot, may favour the public, through the medium of your excellent Journal, with the result of his experiments; or some one may perhaps be able to solve the following queries connected with the subject:—Query 1*st*, Has it been sufficiently proved to exist in the log? 2*d*, Does any local peculiarity influence its commencement, and what is its most probable cause? 3*d*, Does it originate in any particular kind of wood exclusively? 4*th*, Is every kind of wood subject to its infection? 5*th*, Can any thing besides wood be infected by it, so as to be brought into a state of decay? 6*th*, Can any substance, besides wood, act as a conductor of the contagion? 7*th*, Would the disease go on in a continued progressive state, or does it occasionally stop at what surgeons call the *line of separation*? 8*th*, Is the outline or boundary of its progress sufficiently defined? 9*th*, Has any specific been found to arrest its progress, or is a radical cure, by the total removal of the parts, the only safe expedient?

If the insertion of this shall be the means of setting on foot a more general investigation into the subject of the dry rot, and of arresting, in any degree, its baneful influence, my end in view shall have been fully accomplished. I am, &c.

(Signed) B. J.

Banks of Forth, 19th Sept. 1823.

LETTER II.

SIR,

Although a constant reader of your paper, from my occupation it sometimes happens that I cannot see it till it is at least ten days old. This occurred with your Journal of the 20th, in which is a letter, signed B. J. on "Dry Rot;"—a question in which the British nation is deeply interested, while it holds the first navy in the world, which has been, and may still be, the bulwark of this country. From the queries started by B. J. he seems to be a friend and well-wisher to his country, and as such only I would wish to meet him. The subject, however, deserves to be taken up by some abler hand than mine; but as I have, from my earliest days, been employed in rearing and working among trees and timber of every kind, and have paid much attention to the subject, experience, and a thirst for investigating their properties, has put me in possession of facts that are not generally known. I have studied trees from the nursery till they have arrived at maturity; I have also watched them in their decline; yet I confess I am unable to answer the various queries started regarding dry rot, nor do I feel myself at present altogether at liberty to disclose every thing I know connected with this most destructive malady, in a public newspaper, and for this especial reason,—I am just now engaged in preparing a work for the press, in which the time of attack, the causes of the disease, and its progress, as well as the means for preventing it, will be particularly pointed out. But for the satisfaction of B. J., I shall endeavour so far to answer a few of his queries. Then, as to the 1*st* and 2*d*, the disease commences often in the tree whilst growing, and also in the log. In answer to the 3*d*, it originates in every kind of growing wood and cut timber. 4*th*, Every kind of wood is subject to its infection. 7*th*, The disease will stop only when the wood is completely destroyed. It can be prevented before the attack, but after having made some progress when the timber is made into work, it cannot be removed, but the infection may be stopped from spreading.

If B. J. will condescend to make himself known to me, and take the trouble to accompany me to a plantation, I will explain and point out to him, *as* *an individual*, a curiosity,—the disease in its commencement.

Trees, like men, have their infancy, their vigorous youth, their maturity, and their old age and decay, and at all those stages they are liable to particular diseases. The diseases of trees, when young, are often occasioned by bad management, such as not attending properly to heal up such wounds and bruises as they may have received, or cutting off branches, and not paying proper attention to heal up the wounds so made; but there is an infectious disease which attacks trees when growing, and when one tree is attacked with it, it often runs through a whole plantation, and this is the principal foundation of the dry rot; and whenever a tree is seized with this disease, it should *immediately* be cut down. It is the same with logs lying in the timber-yard. One log, when seized with a disease, (which is often the case,) will affect all around it; and such is the case if one joist or one deal in a floor is seized with the dry rot; if means are not taken to stop its progress, it will infect its neighbour, and so on till the whole is infected. B. J. mentions the new church of Alloa as attacked with the dry rot already; but I could mention a hundred houses, not much older than Alloa kirk, that have been finished with American timber, and are already in a complete state of decay.

If the ground-floor of the elegant church of Alloa had been laid with Scotch fir timber from the estates of Gask or Rannoch, in Perthshire, or from the north of Scotland, or with Larch fir, although only of forty years' growth, the floor would have stood for at least a century, without sustaining the slightest injury from dry rot. This should put builders of churches and good houses on their guard in the use of foreign timber.

I am, &c. **R. M.**

Stirling, 2d Oct. 1821.

LETTER III.

Sir,

When any calamity threatens to affect the public at large, every individual is then called upon to render what assistance he can, in averting or suppressing the general evil; and when every individual becomes interested in the cause, and every one makes some exertion, however little, the general effort seldom fails in effecting its purpose.

It is, then, from an individual feeling of this kind that I have arranged my own passing observations, and collected some scattered remarks of others into something like an answer to the ingenious queries suggested, on the dry rot, by one of your correspondents, in a late number of your valuable Journal. Before attempting to answer any of the queries, I may remark, that I entirely concur with your correspondent, that the term dry rot is not altogether applicable to this disease in timber, as the fructification of the fungus, which is either the cause, or a consequence of the dry rot, is seldom without drops of water resembling tears, the Latin name *Lacrymans*, according to Sowerby, has been given to it. The dry rot is one of those evils supposed to be occasioned by a parasitical fungus of the genus boletus, sometimes called *ignarius*, I presume from the circumstance, perhaps, of its having a shining or ignited appearance in the dark. This evil prevails most frequently in damp places, and has often an extremely elegant appearance, hanging in inverted cones, and other fantastical shapes. The sinuses vary from yellow to orange, or a bright red brown. The whole fructification often forms a circle from one to six inches in diameter, surrounded with an outer substance, tender and pithy, or cottony, of a pale brown. The upper part is commonly clothed with a white mucor. This pithy substance, without fructification, is often found by itself, and is very dry; whence it has received the name of *dry rot*. In answer, then, to your correspondent's queries,—

1*st*, Though I myself have not seen the dry rot, commenced in timber, nor cut out of the log, I have heard its existence there confidently asserted by some who have seen it. Another species of boletus, somewhat similar to that supposed to be the cause of the dry rot, is not uncommon on gates and posts exposed to the weather; but in such situations it does not spread much. I have also often remarked a species of the boletus in coal mines, where there was little ventilation and some damp, spreading to a considerable extent on the posts which were employed to support the roof, and these consisted of fir trees with the bark on, but very little decay could be noticed.

2d, Its cause by some has been ascribed to the extraction of the resinous principle from the wood, when in a growing state; others suppose that it may be occasioned by the common practice of floating the timber newly cut, before any of the natural sap evaporates, and of cramming it into the heated hold of a ship, and bringing on some peculiar action, by which its power of resisting decomposition becomes lessened. It is well known that another kind of dry rot originates in timber being felled at improper seasons, or injudiciously prepared, in which case, instead of hardening into a compact texture, being full of sap, which evaporates, the pores never close, and the whole soon becomes liable to internal decay.

Any local peculiarity influencing its commencement, may be reduced to these two causes, viz. the want of a free circulation of air, and to the presence of damp, a very small degree of which being sufficient to call it into action; as proof of which, it is always found to commence on the ground-floor of houses, or in garrets into which rain may have penetrated.

3d, Whether or not that species of boletus, which is supposed to give rise to the dry rot, originates in any particular kind of timber exclusively, I cannot from my own observations, determine; however, from what I have seen, fir appears the most favourable nidus for its germination, in which decomposition, to a certain extent, must have begun, to favour the process, and we have every reason to believe that the rapid decay which takes place is greatly owing to some reaction taking place between, and mutually affecting, these two agents.

4th, In whatever kind of timber the dry rot may have originated, daily observation confirms it as a fact, that a variety at least of other timbers are perfectly subjected to its contagion and ravages, and it has even been found that the rigid oak cannot hold out against its assailing power.

The disease has been known to creep up the feet of an oaken table standing on an infected fir flooring, and in the same way to ascend bed-posts, &c.

5th, I have heard it remarked, that a particular kind of soft slate was readily subjected to decay when long placed in immediate contact with infected timber; but, as I could never trace this satisfactorily, I must leave its solution to those who may have had more ample opportunities of investigation.

6th, After the infected timber has been removed, the contiguous walls have frequently been known to retain and communicate the infection, notwithstanding the application of lime, copperas, &c.

7th, I am afraid few of your readers will exactly comprehend your correspondent's (perhaps professional) phrase of *the line of separation,* which, I believe, signifies a line or visible boundary in the progress of mortification, though I confess I had recourse to my dictionary for information. But, be that as it may, I much fear your correspondent will look long and look charily before he discovers any such line, if a supply of fresh timber is presented to the contagion, and placed under circumstances favourable to its being infected.

8th, The precise outline or boundary of this disease cannot be accurately ascertained.

9th, In this disease, as in those incident to animal life, prevention is much easier than cure. In fact, there is no other cure for the part infected than excision, and the sooner it is done the better;

as the disease spreads most rapidly when fungi are propagated, throwing their minute fibres into the tubes of the contiguous sound timber, and producing that moisture which is a condition absolutely necessary for the putrefactive process." Many remedies, as vague as the hypothetical reasoning to which they owe their conception, have been forced upon the public, and these nostrums enforced with a warmth of recommendation equal only to their complete failure. However, it is a subject of experiment alike interesting to the philosopher, the botanist, and chemist; and, as I have remarked before, still requires a general interest excited, in this part of the country at least, to unravel its mysteries, and to let in the brightening ray of science on all its obscurities.

I have carefully subjected pieces of the boletus to the action of the various acids, but the tardiness with which the strongest of them affects even the vegetable mass, promises little towards their ever being used with success as a remedy or corrective in the dry rot: the strength of acid necessary in any wash that might be employed to destroy the fungus, would, I fear, prove destructive to the wood itself, which might render the remedy equally pernicious as the disease.

However, we know that vegetable as well as animal life is much affected by the atmosphere in which it is placed, and this would lead us to a natural deduction that some means might be resorted to, by employing gases destructive to the growth of the fungus. For instance, a process of fumigation with nitrous acid gas might be tried, which can be so easily prepared by pouring sulphuric acid upon nitre; and as the materials can be placed in almost any situation, the gas could be most effectually applied under ground flooring, roofs, &c. This process would require to be kept up for some days, which can be done on a very cheap scale, and without any risk of injury to the wood;—the timber might even be impregnated with potash previous to the fumigation, by applying it in a strong solution, and perhaps the subsequent formation of a salt might prove a check to the rot.

I have lately instituted a series of experiments on this interesting subject, but have to regret that my results are not yet so conclusive as to allow their being embodied. In taking leave of you for the present, I must apologise for the length of this article; but I assure you it would not have appeared at all, unless from a hope that it might call forth a better reply to your correspondent's queries from an abler hand, or awaken in others an interest in the future prosecution of the subject.

I am, &c.

A CONSTANT READER.

A——, 2d Oct. 1821.

LETTER IV.

SIR,

From what appeared in your paper some time ago on the subject of dry rot, in reference to the destruction which that pestilential disease has wrought in some of our goodliest edifices about Alloa, and as it has again made its appearance in a still more virulent degree, I have been induced to send you a few ideas which have occurred to me in ruminating on its nature and causes. Although much has been said and written on the subject, and although many have been the measures taken, either to secure against its attacks, or to abate its virulence, the disease is still unknown, and in its unwelcome visits has hitherto set precautions at defiance. Nor, Sir, do I now come forward to arrogate to myself the credit of having at last succeeded in discovering the *arcana* of its production and operations, but simply to throw out a few unconnected hints, which perhaps may be the means of guiding some person of greater and more successful research to the discovery of the important secret. The first appearance of this disease was in the house presently occupied by the Rev. Mr. Fraser; and about a year ago, after various attempts to check its progress without success, the infected timber of one of the rooms was completely removed, and replaced by well-seasoned Baltic timber, laid in clay; yet, notwithstanding these precautions, it has again lately exhibited itself in the same floor, under circumstances which betoken no amelioration. Nor is this all;—it has made its appearance also, and has wrought no small degree of mischief, in all the adjoining new buildings, with the exception of two of the villas to the westward of the lately erected parish church; nor have the stateliness and beauty of that edifice itself rendered it proof against its vexatious encroachments. Now, Sir, in attempting to investigate the origin of the evil, I would humbly propose, as my opinion, (an opinion which facts will serve to render at least plausible,) that it exists neither in the soil, according to some, nor in the timber, according to others, but in the mortar used in building. That the soil, in the present case at least, has no influence at all, is, I conceive, sufficiently disproved by the fact, that the two houses hitherto untouched by the disease, are so much in the vicinity of those infected, that the possibility of a variation of soil cannot once be admitted; and that as little blame can be attached to the timber, is evident from the fact, that the timber used in building both the infected and the uninfected houses, was not only of the same quality, but of the same cargo. Here, perhaps, I may be allowed to remark, in passing, that, in all the cases which have come under my observation, American timber appears to be less subject than any other to the inroads of this disease. To revert to the subject of mortar:—It is an accredited fact, that the lime used in building these two houses which have withstood the infection, has almost nothing of uncalcareous matter in its composition, compared with that which has been most commonly in use. It is also well known that the former is much more rapidly slacked, and of consequence can be much sooner used than the ordinary lime; and I have no doubt, but to this circumstance, joined to that of its having comparatively no admixture of argillaceous matter, may be attributed the preservation of the timber from the influence of this mischievous disease. As the timber of Mr. Fraser's house, when last replaced, was laid in clay, as a *dernier resort*, which circumstance, instead of retarding, seems rather to have accelerated the progress of the distemper, and as the lime commonly in use contains considerable quantities of argillaceous earth or clay in its composition, may we not hence conclude, that there is something in the lime which has a tendency, if not to produce the disease already referred to, at least very much to favour its destructive ravages? And, on the contrary, from the facts already stated respecting the vicinity of the uninfected houses, and the sameness of the timber employed in *their* construction, may we not also conclude, that it is to the comparatively small quantity of argillaceous matter in the lime used in building them, along with other of its peculiarities, that they owe their preservation from this ruinous malady? In coincidence with what has just been said respecting the influence of clay in producing or fostering the disease in question, it may be here observed, that the soil of London is chiefly of the argillaceous description, and no where do we find the rot so prevalent and so destructive. On the other hand, in Dunbar, where the lime of which I have been speaking is universally in use, I have the best authority for saying, that nothing like dry rot has ever made its appearance. And, Sir, in concluding these few hints, I consider it of importance to mention, that the lime used in building the two houses already alluded to as having withstood the infection, although in its immediate vicinity, was procured from the limestone quarries at Skateraw, on the estate of Dirleton, and wrought by Mr. Brodie of Scoughall,—I am, &c.

S.

LETTER V.

SIR,

I perceive in your paper of the 8th inst. an ingenious letter from a correspondent signed "S." on the subject of Dry Rot. It appears the writer entertains a notion that the disease is to be attributed to the qualities or nature of the mortar used in building: that the disease will appear in proportion as the lime used is free from uncalcareous matter, joined to that of its having comparatively no admixture of argillaceous matter. This I suppose to mean, that the mortar used is pure lime, and free from any clayey substance. The opinion is so widely at variance with my own knowledge, and with what may be daily observed of this pernicious disease, that the subject naturally suggested to my mind a number of queries, from which I beg leave to submit the following for your correspondent:—

1st, Is it argillaceous mortar, (which I suppose to be mostly clay,) or what else is it that causes dry rot in ships?

2d, Is it clay, or what else, that occasions it in the flooring and joisting of houses, in the second or upper storeys?

3d, Is it clay, or what else, that causes it to take hold of the log, before it comes into the hand of the sawyer?

4th, Is it clay, or what else, that causes it to seize on the trees, while growing in the forests, and actually kills them?

5th, Is it impossible that a vessel, containing timber, might not carry logs infected with the dry rot, and logs not infected with it?

I shall mention one curious fact connected with this subject:—A few years ago, there was a fine looking brig built at Dundee, 140 tons register. She was built for sale, and for that purpose was sent to London, where she lay for nine months. Not meeting with a purchaser, she was brought back to Dundee, where she lay for nearly four months more without a buyer. Her wearing and outside planks, below the bends, were American oak. As she did not meet with a market, her owners were going to put her to sea, and, on examining her, found the planks infected with the dry rot. They began to take them off, when they found all the planks to be affected, and even some of the timbers, which were of British oak, all of which had to be renewed before she could be put to sea.

The superintendents of buildings in Glasgow and Greenock now watch the dry rot with the utmost vigilance, and, often before the buildings are finished, many of the joists, even of the upper flats, have to be replaced.

I am perfectly of opinion, Mr. Editor, that the dry rot exists in the timber, and that too in all kinds. I am also aware, and I agree with Mr. S., that the disease, under some circumstances, and in some situations, may be hastened.—I am, &c.

R. M.

9th Dec. 1822.

My reason for inserting the letters here, two of them being from myself, viz. letters second and fifth, is, that when these were published, a great many questions originated from them. To answer all the queries put respecting this disease, or to sum up evidences of its direful effects on many a stately ship, as well as house, would be both a useless and uninstructive task; but to probe the wound to the bottom before applying the cure, we may consider a little its origin. That there is a disease to which timber is liable, most commonly known by the designation of dry rot, no one will deny; and from whatever causes it may originate, the great business is, if possible, to stop its destructive effects. This disease, then, often attacks trees when growing, and springs from diseases in the roots, (see page 423,) diseases by insects, page 421, diseases by moss or damp, page 422, diseases by canker, external injuries, &c. page 428, all which, but particularly those of insects, (although imperceptible to the eye, like the mite in cheese,) lay a foundation for this disease; and a cancer in the body, or a canker, (a better name for the disease than dry rot,) sooner or later destroys the whole log, unless measures be taken to prevent it. Trees cut down when very healthy, before coming to their prime or maturity, are subject to this disease; which originates from the great quantity of sap-wood, which, if trees lie long in the log, always begins to mortify; and this gangrene is always infectious, whether begun in a plantation, in a timber yard, in a timber or plank of a ship, or in the joist or floor of a house. Trees allowed to stand after they have arrived at full maturity, and begun to decay before being cut down, will also be subject to the disease. Trees that have remained healthy throughout all their stages in rearing, that have arrived at maturity free from blemishes, that have been cut down when fully ripe, and all the sap-wood taken off them before being put into work, without receiving infection from a diseased neighbour, will only fail by the stress of wear or the ravages of time: therefore, properly speaking, trees, like any other growing vegetable or commodity, should never be used till they are fully ripe; and when healthy throughout their course of life, cut down, the sap-wood taken off, properly seasoned before put into work, will be found most perfect and durable, without the assistance of any art to make them so. But as it would be altogether impossible to allow all trees to stand to be fully ripe, or to arrive at maturity, and as absurd to say that all trees cut down before arriving at maturity should be thrown away as unfit for use, we must therefore try to do by art what we cannot allow to be done by nature. Before entering upon the cure of this virulent canker, (which, as I mentioned before, would be a better name for the disease than dry rot, but this being a common designation, I have all along confined myself to it,) I had a great many opinions on this subject, from different quarters, which I had prepared to insert; but this volume having already far exceeded the bounds at first prescribed to it, I must omit them, as they would only bewilder and fatigue, and would by no means instruct the reader in any thing useful on the subject; and my own opinion must also be condensed as much as possible. I must here, however, be allowed to observe, by the way, that all wood used for any particular purpose, should be well seasoned before being used: for this purpose all kinds of trees, without exception, should be stripped of their bark before being cut down; and this should be done any time from the first of April to the end of August, and the trees allowed to stand till the month of October or November the year after, say for twelve months at least after being barked, and immediately after being cut down, all the sap or white wood hewn off it. This may be said to be attended with a great deal of expense and trouble; but all trees to be used for any particular purpose should be dealt with in this way, and it will be found much more durable. At any rate, all kinds of trees of value should be cut down (if not stripped of their bark standing) in autumn, and immediately after squared up, by taking all the bark and sap-wood off, and exposing them to the air, keeping them from the sun, to preserve them from rending, till they are fully seasoned and fit for work. No tree whatever should be put into a piece of good work with the natural sap in it: by a careful selection of wholesome, sound timber, and properly seasoning and managing it before putting it into work, diseases may be greatly prevented.

But to come to the prevention and cure of the disease *(dry rot)* in timber, let the log, plank, or piece of timber, be dressed up, or nearly so, to the purpose for which it is to be applied, and then put it into the steam-box or stove, (see the Plate with its explanation;) fill the boiler with the liquid extracted from oak timber, put in a quantity of lime shells betwixt the steam pipe and the end of the log, as represented in the figure, and steam it with the liquid for five or six hours; if a log or piece above a foot square, allow it to cool for four hours, and then put fire to the steam-stove below, and keep it burning till it is properly scorched and hardened by the fire, so as not to consume any of the corners of the log or piece of timber. As I said before, the timber should be made very near its shape and size, which can be very easily done in timbers for ship-building, or roofing, joisting and flooring of houses; as after it is fired, it will be exceedingly difficult to pierce with a tool. A difficulty arises here, as to the planks of vessels, as these must be applied to the ship's sides, from the steam, in order to make them bend; in these cases they would require to be steamed a second time, after being burned, with the same material. This plan may be said to be attended with a vast deal of expense; but this will not be so much as might at first view of the matter be imagined, as there will always be found about a ship-builder's yard as much refuse of oak timber as will keep a sufficient supply of the oak liquid; and even when it is required to be bought in, plenty of it can be got for twopence halfpenny per gallon, and half a gallon will be found sufficient for every solid foot of timber; and the expense of steaming it is a mere trifle compared with the benefits to be gained from it. For a more full explanation of this, see the plates and figures of dry rot.

But here, as I have ventured upon new ground, I shall be said to be more theoretical than practical, which I have all along studied to avoid. To give one or two instances of the trials I have made:—In 1816, near eight years ago, I made trial on a piece of Scotch fir timber, that had lain amongst long grass with the bark on it, for four or five years, which had all begun to corrupt, and was steamed with the lime and the tree liquid; which piece of timber, I am well aware, would not otherwise have stood above another year or two at most, but it has now stood exposed to the weather for eight years. This was only done by the steam of the liquid and lime, without burning. I tried this also with a piece of round oak timber. This piece was cut off the end of a tree that was rapidly consuming with a rot, from the root end of it; which tree was about eighteen inches in diameter, and the piece cut off about three feet long. The rot in the end of the tree was hardly perceivable when the tree was cut, and in three years it had eaten or corrupted up the trunk of the tree for fully two feet, and more than one foot in diameter at the bottom, and was observed to make a degree of progress in extending its ravages every six weeks; and I have no doubt would soon have gone through the whole tree, or log, which was eighteen feet long. I steamed this in the same manner as the fir piece. This was in 1818, now ten years ago; and since that time it has not made a single hair-breadth of more progress in the rot. It is here worthy of notice, that the remainder of the tree, or log, was used by Mr. Kewin, ship-builder, Dundee, in a ship, and has since had to be replaced, although, when the piece was cut off, there was not the slightest sign of the rot having reached above the cut. I have also taken the most open, porous kinds of timber, and steamed them in this way, and made them perfectly impervious. The liquid evidently contracts the pores of the timber, and it must be clear to a demonstration, that it will most effectually extirpate every insect that could be in the tree or log. I have also tried it with old planetree table tops, where the rot by worms was visibly making rapid progress: which completely extirpated the worm, and stopped its ravages. I must also observe, that I had not the proper means of trying those trees, and could only do it by closing them in a large boiler, which could by no means do them the same justice as if they had been in a proper stove. But when this succeeds in the imperfect manner in which I was enabled to make these trials, I have no doubt in asserting that it will be found, if properly attended to, to cure completely that disease in timber known by the name of dry rot, and must be of the greatest importance in ship-building, particularly when the means of doing it is so easy, and the expense so trifling; which, I must be allowed to say, is much more simple and cheap than any thing that has as yet been attempted. For a farther illustration of this, see the explanation of the Plates.

SECTION XXXV.

DIFFERENT SOILS BEST CALCULATED FOR TREES.

THE nature and qualities of the different soils best adapted for growing and rearing woods, the most profitable for the planter for forest trees, have before been, in some degree, taken notice of, and having already exceeded the bounds at first prescribed to this work, upon this I shall be very brief, the more so as I intend, should this volume ever come to a fourth edition, to give at large the best, surest, and speediest means of propagating every kind of tree, with the soils and situations best suited for bringing them to maturity. The best way of ascertaining with any degree of precision, and the only criterion to judge the soils by, is carefully to observe in what particular soils trees arrive most speedily and safely at maturity. I have observed that the oak grows fastest, and makes the best hearted timber, on strong good clay soils. Such is the case with the oaks mentioned on the estate of Alloa. These trees, although very rapid in growth, are most excellent timber. In a tree from two to tree feet in diameter, there will not be above three quarters of an inch of white, or sap-wood; and in the very heart of the topmost branch there is little or no white wood. It is the same with the oaks on the estates of Airthrey and Alva, on the face of the Ochil Hills, and also at Inverary, in Argyleshire; but there the trees do not grow so fast. As was observed in the section on planting, the oak, (which is fortunate for this country) will almost grow on any soil, as will also the Spanish chesnut, elm, ash, plane, and beech, which are the most valuable trees. The larch fir will grow in almost any soil, but will by no means come to be any thing like good timber or to maturity on freestone rocks. I have always observed, in all places of the country, where larch was cut from off a freestone bottom, that even at the age of twenty years it had begun to decay at the heart, and the decay proceeded from the root. I have seen some larch trees cut from off freestone rock at the age of forty years, and the whole unsound at the root, and some of them rotten for eight feet up: I am therefore of opinion, that larch should never be planted on a freestone bottom, if intended for timber trees. The following letter from C. G. Stewart Menteath, Esq. of Closeburn Hall, in Dumfries-shire, confirms what I have seen, and know from experience to be true as to this.

"*Closeburn Hall, October* 19*th*, 1821.

"SIR,

"When I had the pleasure of seeing you in Edinburgh, I mentioned to you some things relative to the soil most suited to the growth of the larch tree, which I had observed in a number of larch trees. I had occasion to cut down some of them of the age of fifty years and upwards. I was much surprised to find most of them somewhat decayed at the root, for some feet up the stem of the tree, in some instances above six feet. These trees were almost all red wood. It seems to me to be a disease produced from the soil the tree grows upon, which I saw confirmed in a tour I made through Switzerland a few years ago. The lower country of Switzerland is generally freestone, and the sides of the lower mountains limestone: upon these soils I observed no larch trees growing, till I came to the mountains composed of primitive rocks, such as gneiss and slate rock, where I saw magnificent larch trees growing; one of which I measured that had been blown up by the root, and had grown at the height of 6000 feet above the sea. It was sixteen feet in circumference at five feet from the root. From these observations, I am led to think that the natural soil for a larch tree is the slate rock, and upon freestone or limestone the larch will not be a long-lived tree. Indeed, upon the freestone gravel I find many of the larch trees at the age of twenty years formed entirely of red wood, and in these trees the decay is commenced at the root.

I am,

Sir,

Your most obedient servant,

(Signed) C. G. Stuart Menteath."

This letter, together with what has come under my own observation, convinces me that the hue and cry raised lately against the larch fir from the Duke of Athol's estate, and others throughout all the country, asserting that the larch fir is by no means a durable timber tree, and that proofs are already seen of its decay, is entirely owing to the use of trees of this kind that had begun to decay before they were cut down, owing to the soil they were reared and grew upon; and that trees of this kind should never be put into ships or good houses. But these trees are by no means any just criterion for trying the durability of the larch fir, as they carry along with them the diseases contracted in their infant state from the soil, &c. and never can be durable, although the rotten parts should be all cut away. This is the sole reason of the cry raised of late against the durability of the larch, as the timber of those trees will not last like the timber of good healthy ones, without being steamed and fired, as directed for dry rot.

SECTION XXXVI.

MODE OF SALE OR LEASE OF NATURAL WOOD.

As so much difference of opinion almost constantly occurs at the sale of a natural coppice wood, it may not be deemed improper here to state precisely the articles by which it should be sold, relative to the manner of cutting and clearing the ground, &c. This may be the more necessary, as the time may not be far distant when landed proprietors, having twenty-four yearly hags, or cuttings, may let them on a lease of twenty-four years, the same as a farm. This would be a most advantageous way for the wood-cutter, or bark-dealer, as he would then be yearly in the market, have always a command of the most experienced workers, have implements always in readiness on the ground for carrying on his work, and the most of his work confined to one estate. Great inconvenience arises from a person having a hag on one estate this year, and on another the next, and these, perhaps, 100 miles distant, and no cutting at all some years, and so on, which often happens; and, besides, he would have a *most* particular interest in attending to the rearing *of his* coming hags, to see that every inch of blank ground was filled up, and every attention paid to make them produce more bark and more timber. This would be no less advantageous for the proprietor, as the tenant having such a particular interest in rearing his woods, he would be sure to get them in good state at the end of the cuttings; and, of course, the next letting would bring a vast deal more annually; and his forester would only have to see that the tenant does his duty. Were I twenty years younger, I would have no objection to take a lease of 1000 acres of natural wood land, even in its worst state, and give the landlord a fair annual rent for his land, and at the end of twenty-four years be sure of making an independent fortune; at the same time greatly enriching and advancing the interest of the landlord.

ART. 1. The purchaser is hereby bound to cut all the barren or black wood of every description, the oak excepted, on or before the first of May next.

Art. 2. The purchaser shall be also bound to cut all the plants, or seedling trees, included in the sale, with a saw, two inches above the surface of the ground, and to dress the stool with an adz, rounding it down from the centre, close to the surface of the ground; and on no pretence whatever shall he be allowed to peel off, or even to loosen in the smallest degree, any part of the bark below the cut of the adz; and if a stool that was formerly high cut, to be cut and dressed down to the surface of the ground, rounded in the top so as not to lodge water, as directed in Sect. VII. and VIII. of this work. These stools are to be immediately dressed up after the trees or stems are cut; that is to say, of every tree or stem that is cut, the stool shall be dressed up the same day that it is cut, so that the young suckers, or saplings, may not be in the smallest degree impeded in their growths.

Art. 3. All the brush wood must immediately be removed off the top of the newly cut stools. All horses and cattle are expressly prohibited from going at large, or pasturing in the newly cut wood. And in removing the timber or bark, the carts are not to be allowed to drive across, nor is the bark to be stacked on the top of any of the newly cut stools, unless it is to be removed on or before the 10th of July next.

Art. 4. Reserving from the said hag of wood to be cut, all seedlings, or young plants of every description, at and under four inches in circumference three feet from the ground; as also, reserving such a number of oaks, ashes, &c. as standard trees; (let it be here observed, that the trees to be reserved, besides the seedlings, must all be marked and numbered before the wood is exposed to sale;) which trees are all marked with a ring of paint, and numbered on the bark with a wood-iron, from No. 1. up to No. —. Nor shall the purchaser injure these reserve trees, or seedlings, in the slightest degree, with the felling or cutting of his trees.

Art. 5. The purchaser is hereby also bound and obliged to finish the cutting and barking of the whole lot or hag intended to be cut this season, on or before the 10th of July next; and on no pretence whatever is he to be allowed to cut after that period. And he is to have all the cut stools properly dressed up for the growth, as aforesaid, the first lawful day after the cutting is finished, even though it should be finished before the 10th of July.

Art. 6. The purchaser is likewise hereby bound to have the whole of the wood and bark removed from without the newly cut hag, on or before the

3d of August next, and also cleared of all brushwood. And he shall be allowed a piece of ground in a corner of the wood, or without the wood-gate, to stack whatever of the bark is remaining, and to lay down the remaining wood to block his spokes, &c. or otherwise to manufacture the timber. The newly cut hag is to be properly fenced in, and the wood-gate locked by the 3d of August.* The purchaser shall also be allowed such places, within or without the wood, to burn charcoal upon, as shall be pointed out to him by the proprietor's steward or forester.

These are the only articles by which a purchaser ought particularly to be bound. The others, as to times of payment, and the extent of penalty on a breach of any of them, and all to be performed to the satisfaction of a person properly qualified for that purpose, can be made out according as the circumstances of the case may require. In the event of the hags being let on a lease of twenty-four years, the tenant ought to be bound to keep and rear the wood as in the manner laid down in the sections on cutting and rearing, &c. of natural coppice woods; and this must be particularly attended to. When the thinnings of old belts, groves, or standing plantations are sold growing, and to be cut down by the purchaser, the trees sold should be all properly numbered with a wood-iron; and every purchaser, when he cuts down his tree or trees, should be bound to put the same number on the root, or stool, that was on the tree before it was cut. This would save a great many disputes, both between the exposer and purchaser, and also between the purchasers themselves, which often happens when these thinnings are sold in small lots to different purchasers.

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* As the second, or Lammas growth, is the only growth that determines the future prosperity of a natural oak wood, the young shoots ought to be preserved with the greatest care and attention, as they very often make most vigorous growth, and continue growing, if the frost does not become intense, till December, and often grow to the length of four, five, or six feet; but this growth is very tender, and easily hurt. And when these growths are much disturbed, it often makes them come out from the stool in a horizontal manner, so as to run along the surface of the ground; and ten to one if ever they can be brought to an upright position. This is one of the reasons why the greater part of our coppice woods are so scraggy, and crooked, and stunted in their growths.

APPENDIX.

No. I.

TO THE EDITOR OF THE NORWICH MERCURY.

SIR,

I HAVE perused with much interest the table lately published by Mr. Withers; but though I conceive he has greatly under-rated the profit to be derived from the mode of planting he has recommended, I find there are many gentlemen who doubt whether it be possible to cause trees to grow, even with the aid of manure, at the rate estimated by him, and consequently whether the profit he states (L.1305, 9s. 8d. an acre in 64 years) can be realized. I am confirmed in my opinion by the facts stated in a very excellent work, published in 1824, by Mr. R. Monteath of Edinburgh, entitled The Forester's Guide and Profitable Planter, which I have lately seen. In the introduction to that work, page 12, Mr. M. states, "There is at present on the estate of Inverary, the property of the Duke of Argyle, a plantation of larch firs only 16 years old, bearing 1000 trees on each acre; every tree is well worth, and would sell at the present time, (taking into consideration the reduced price of timber) at 4s. being L.200 sterling the acre, which, after deducting the expense of planting, and allowing a fair rent for the land, with interest and compound interest, will yield at least L.8 an acre of annual rent; the thinnings having paid more than the expenses of fencing the plantations, &c. Here we have a return and an amazing profit in 16 years. There is on the same estate, a silver fir tree, 70 years old this Spring, girthing 10 feet, containing upwards of 300 solid feet; there are hundreds of trees the same age and nearly the same size on the same estate. An acre of land will easily carry 60 such trees; which, at the low price of 2s. per foot, will amount to L.1800 an acre. There is also on the estate of Airthrey, in Stirlingshire, the property of Sir Robt. Abercromby, a plantation of ash trees only 59 years old, averaging 600 trees on an acre, and many of these trees have upwards of 60 feet of a bole, without either knot or branch, girthing four feet, the average solid measure of the whole being 32 feet each tree, which at 2s. 6d. per foot (a low price for such trees) is L.4 per tree, being no less than L.2400 per acre; and I am well informed that the thinnings of these ash trees have paid a fair rent for the land ever since they were 15 years old. What an immense sum for the crop of one acre! Who will dare to affirm that plantations are not worth care or attention in rearing, even laying ornament and shelter aside?"

Mr. Monteath also gives an account from actual measurement of the growth of 12 trees, by which it appears they increased 353 cubic feet in 16 years, which, if sold at the low price of 1s. the cubic foot, would amount to L.17, 13s. He says, if we suppose a Scotch acre of ground planted with trees thriving at the same rate at 10 feet distance, it would contain upwards of 540 trees, and yield an increase of 15,865 cubic feet in 16 years, which, at 1s. per foot, would amount to somewhat more than L.794, which gives L.49, 10s. for the annual produce of one acre.

These facts I should think are sufficient to satisfy the most sceptical, that Mr. Withers has not made too high an estimate of the profits of planting, and if more be wanted besides what is given in his pamphlet to prove the effect of manure, and a proper preparation of the soil, I would refer to his neighbour *Admiral Windham*, on whose estate the most unanswerable evidence exists on the subject. That gentleman possesses unquestionably as fine and valuable a wood for its age as any in the county of Norfolk, and perhaps in the whole kingdom, and was so considered by the late Mr. Nathaniel Kent, who thus mentions it in his Survey of Norfolk, published in 1794.

"Mr. Windham of Felbrig is also a considerable modern planter. Most of his plantations have been raised from seed, and there is *one that stands unrivalled*; it was sown with acorns, Spanish chesnut, and beech-mast seventeen years since; has been already twice thinned for hurdle wood; the trees, most of which are 30 feet high, being at the regular distance of 12 feet, with a valuable underwood at four feet distance. This plantation was *taken out of the park, was well fallowed the preceding summer to its being sown, and during this state there was a flock of sheep in the park, which were continually laying on the fallows, to which in a* great measure *I attribute its astonishing floridity, as it surpasses every thing of the kind I ever saw*, and therefore I mention this as a thing worth attending to."

Here is a growth of trees of 30 feet in 17 years, being at the rate of 23 inches annually, and exceeding the estimated growth in Mr. Withers' table by eight inches in a year; but observe the land was *taken out of the park, was fallowed the summer preceding the sowing, and folded with sheep,* to which Mr. Kent attributes the astonishing floridity of the plantation, and its superiority to all others that he ever saw. The superiority of this most beautiful and valuable wood is still maintained, but in a degree much greater than at the time Mr. Kent wrote, and it now stands a splendid proof of the utility of fallowing, and the power of manure in planting, affording also the most conclusive answer to those who think that the early stimulus thereby given to trees will cease to operate in after years.

AN AMATEUR.

October 16th, 1827.

⁎ The above letter is a recommendation of Mr. Withers' table, which was sent me by the Author, and as it may not be uninteresting to my readers, I have inserted it in the Appendix.

No. II.

COPY OF A LETTER FROM P. MASSINGBERD, ESQ. TO MR. ROBERT MONTEATH.

Sir,—The extreme pleasure that the perusal of your Forester's Guide (2d edition) has afforded me, is deserving of infinitely more than the thanks of an humble individual such as is he who now takes the liberty of addressing you; nor, I trust, will you think it impertinent. I have a few, very few remarks to make upon your interesting "Guide," though two or three that, perhaps, you will consider as at least worth turning over in your mind, if unworthy of adoption. In the love of planting I will not even yield—though to the superior judgment and experience of Mr. Monteath I readily submit. I have planted, besides many bushels of acorns, nearly half a million of trees. My soil is, generally speaking, a stiff clay, quite pure, or chalk and clay; and, as you will know, rather of the moistest; this I mention to you, as you will draw your inferences. Not to take up too much of your time, I shall be concise. At page 106, you condemn all pruning of firs. I have about 100,000 larches, of all ages, from the size of my little finger to three feet in circumference, of my own planting: as they are for profit, and not in gardens or in lawns, I prune them all; *and am thoroughly persuaded that they are infinitely benefited by so doing.* What may be the largest size larch tree in *England*, and its age? Pontey has long been my oracle; but, like the bee, I wish to gather sweets from *every* flower. When I first began to prune, I exercised my knives and saws upon limbs of so large a diameter, that I did much harm—that was not Pontey's fault; I now spare my large oaks, and prune the *boughs*, as I used to prune the stems; and more than you would approve of; but then I argue, that what I lose in quality, I more than repay to myself in quantity; besides which, in hedge-rows, I am obliged to trim up more than I approve. I simply paint over the wounds. I feel ashamed to say I have had time only to read your work once over—*I think it an invaluable assistance to me.* I lament that there is no appeal from you to the government for protection, as an encouragement to us who spend such enormous sums for the good of posterity. How interesting are the remarks we read, on the necessity there is of planting oaks—in the memoirs of that great and good man, Lord Collingwood—and if necessary—as he so ably sets forth—ought we not to be encouraged, and protected by government? I sell my bark at five pounds a load! and my timber in proportion!!! *For bark there should be a protecting duty;* and I felt no patience when I read the review of your work, in the subject's not having been noticed, *though otherwise so well written.*

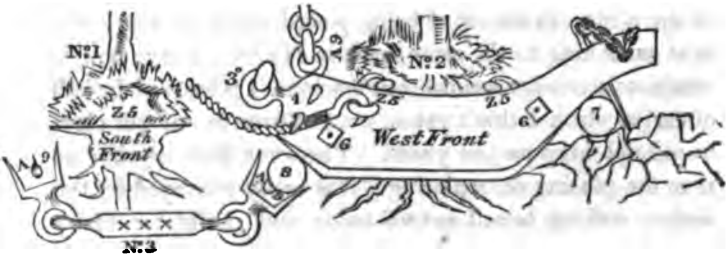
I have no reason to complain of the growth of my trees; all grow well. The silver fir, the oak, *Spanish chesnut*, ash, beautifully—in short, all; not the *plane*, the air is too keen: and yet you puzzle us "Southrons," in no small degree, by talking of "*planes*" so far north as Stirling, &c. *White* American spruce I can scarcely get to live. I have a beautiful pineaster, or Stone pine, from which I am growing many plants; the wood is two-thirds heart, and is beautiful. A very respectable seedsman, close to me, at Spilsby, John Cole, calls it the stone pine. I think he is mistaken: the difference of climate would not so materially alter the fruit, *or it would not ripen to increase its kind.* About Bourdeaux the *stone pine* is eaten, as Cockneys eat beech-mast; *whereas the fruit of my pineaster, is not hard in its shell, or of size at all to compare to the stone pine.* I have the Corsican fir, a great beauty; the *herissé*—the botanical or English name I know not; and the *pin maritime.* The seed was sown *last spring.* The plants *this year,* are most of them two feet high—some two feet one inch. Described in "Nouveau Cours Complet d'Agriculture" as the quickest growing fir that is known. I got the seed last year at Villemorin's, the *famous* seed-shop at Paris. But, alas! I know not where to get the seed of the real Scotch fir, of which you, Sir, speak; if we could make any exchange, how much gratified I should be.

As you well know the endless expense attending the planting and fencing off *single trees,* I have been racking my brains to invent some cheaper method. I now flatter myself that I have succeeded. I plant *with two or three haws, or sets of quick,* as many acorns, two or three seeds of acacia, and as many ash keys all together. I then, to protect them, drive into the ground three strong elder stakes, which meet in a point, and are about six inches out of the ground. They require, also, a few thorns for their protection, till they have thoroughly taken root, to be bound round them, to keep off the cattle. A dead fir tree, *not pruned,* makes an excellent fence against cattle for a single tree. No cattle will bite elder; and they are too low for even sheep to rub against. Elder grows freely from cuttings, and as it gains height will spread, and in spreading, and heightening, will, I trust, protect at least *some* of the young brood under its wings; the tufts thus spread about the park will be very picturesque, and when the oak is sufficiently strong, it is only to cut down the remainder, and you have an oak without having been transplanted; which plan is strongly to be recommended amongst trees that have been transplanted of a large size—as it is almost certain they will decay *many years* before a tree raised on the spot from seed. Acacia is one of my favourites; I am growing it to plant in the plantations for gate-posts, &c.—The soil suits it, and it runs like a nettle.

You made me smile at page 225. "It is perfectly evident," &c. Do you, at this place, mean to vindicate your remark at page 106, that it is better NOT to prune firs? Because, if you do, I suppose you mean to say that the more knots the better. I was standing by my carpenter when a vile black huge knot broke his plane, and in no good humour he put it away. I smiled; he then said, "Ah! Sir, in 50,000 of yours, no such thing will be met with." Your recovering *dead* trees is really very curious (page 315); I imagine it was only *kilt*, not kilt-dead. In England we do not know what a *saugh* tree is (p. 40), afterwards explained (p. 217); but what are *cleading* waggons? Little alterations in a future edition would be worth attending to.

I am far from intending to find fault with my "Guide;" but, the cause chiefly of my taking the liberty of addressing you, I have not yet mentioned. You give us a drawing of a machine for transplanting trees, that, I humbly presume, I can improve upon—Plate III. When drawn up, all the soil would fall from the roots, even in my soil. I will draw my plan, and then explain it afterwards.—

THE GUNBY PARK SLEDGE.



Now, having drawn the plan of my sledge, I must endeavour to explain it. No. 1 is the tree prepared to have the sledge placed under it; the three crosses × × × being to the south; the sledge opening to any extent, as drawn 3°. No 2 is a *west* view of the tree, as placed upon the sledge; but still growing with all its roots, as in No. 1. A 9 is a strong chain, which is not only to fasten round the bottom of the stem of the tree to keep it upright, *but* is also for the purpose of having a screw-jack placed under upon (8), which is a rammer; serving as a lever; the fulciment being at 7, a strong iron pin passing through, and being chained to the sledge; a rammer also being there placed to prevent its sliding, or giving way. While the screw-jack is raising the sledge in front, a labourer cuts away the roots at the bottom; and having locked the two broad strong flat iron bars (Z 5) under the boll of earth, across, upon the opposite part of the sledge, the tree has now only to be fastened with the chain, by which it was raised, and the horses to be fixed to the sledge. The rammer in front will be found of great use, *being round*, to help the sledge out of the hole. 6 is intended to mark the place where a strong iron bar is fixed in with a nut, and passes (*within*) from one side to the other, with a hook and staple to prevent the sledge from wavering. 4, represents two (or more) strong hooks, that the rope may be raised higher or lower, as required. The sledge is shod with iron. A screw-jack, as I have heard it called, would be more appropriately styled a screw-box; it is what is used in timber-yards. No. 3 is the extreme end of the sledge, in the act of being placed under the tree; A 9 here answering to the same mark in No. 2. I have now to vindicate my sledge against your machine. I preserved the ball of earth, which I think yours, no, not even in our stiff clay, would not keep on ten yards. The screw-jack requires no time for placing or replacing; it is easily conveyed on the sledge, difficult to put out of order, and useful for many other purposes. I trust you understand my drawing; if so, you will see that the ball of earth is supported by *four* cross bars; viz. the sledge on each side, and the flat iron bars (Z 5) before, and behind. We draw the sledge over the hole in which the tree is to be replanted; and can then, *with one man*, by unlocking the four bars, (two marked Z 5 and two 6), leave the tree in its place, and return to take another, which, in the meantime, his fellow-labourers are taking up; whereas, with a common sledge, I am obliged to have three, four, or five men to move a tree. I lately moved an ash 35 feet high, the ball of earth at least six feet diameter, and two feet in thickness. I moved it on *your* principle; my sledge did not open: placing the sledge upright on its end, under the roots—fastening the tree (with a chain,) which, being horizontally placed on the ground, brought the head of the tree to its natural position, as the sledge advanced, drawn by two powerful horses.

How much better would it have been, could I have placed my "Gunby Park Sledge" *under it;* how much labour it would have saved, and how much danger of injuring the tree avoided; *for when we got it to the hole, the difficulty was as great to take it off, as to place it on the sledge, and greater;* as you know of what consequence it is, not to damage the ball of earth or *roots.* I shall hope for the favour of a letter from Mr. Monteath, and that he will not think me impertinent. If any thing I have said is worth your notice I beg you will make what use of it you like. I sincerely wish we had such a man in our neighbourhood. Do you ever come so far south as this? Not being willing to cut down some thriving *silver firs*, to make room for others, I pruned them from top to bottom; leaving only SMALL shoots: I find they shoot out again like elms. If you could send me only an ounce, or half an ounce of the REAL Scotch fir seed I should feel myself greatly obliged to you. I must observe that I have not attended to proportions as I should have done, in sketching my sledge. It would require an artist to sketch it accurately; and here I must venture to say that your plates differ sadly. XIII, XIV, XV are beautifully drawn, XII *very bad*, VIII *bad*. Should not the layer pass under ground? VII is the worst of all: Fig. 22, the first stool has only three shoots; then, afterwards, *seven*. I should have thought, that after the first thinning, they would progressively have had fewer and fewer. But the whole plate is unworthy of the book and the times we live in; the last three are very good.

I am, Sir, your humble servant,

P. MASSINGBERD.

Gunby Park, Spilsby, Lincolnshire.

P. S.—Page 90 is the manner I now prune my oaks, &c. 237—I have tried *various ways*, as recommended by one Phillips, of tapping my firs, but cannot make it answer. On the best method, or if possible, at all, in our climate,—I hope you will give us some information in your next edition, on the subject.

I have inserted this most interesting letter, from the pen of an independent proprietor. The machine which he describes, is simple, ingenious, and cheap, yet of more utility, and serving the purpose better, than those which cost four times its price, and bids fair to set aside Sir Henry Stewart's or my own for the same purpose. Besides, its usefulness in removing large stones off land, and other purposes to which it may be applied, makes it very interesting to every improver of land, and well deserves a place in a work that would give it more publicity than that of my Forester's Guide.

EXPLANATION OF PLATES.

PLATE I.

Figure 1. Surface-draining plough, see page 58, &c. This plough is intended to cut two furrows at once, and that chiefly on rough, uncultivated lands, so that every part of it should be somewhat stronger than the common plough. As the construction and make of the plough is now universally known, very little need be said upon it here. All that is necessary to say is, that the screw-bolt in the end of the beam, with the cross tree, is to be let up and down at pleasure, according to the deepness of the furrow; and the cross tree for the horses to draw by, so that they can go upon the land, or what is called the selion. The design of the chain from each end of the cross tree is to keep it more steady, and to take part of the strain or burden of the screw in the end of the beam, in the event of the horses not drawing equally. The first coulter is placed in the centre of the beam in the usual way, about six inches before the other two, and it cuts the centre or division of the two furrows; the other two coulters are placed opposite to each other, one at each side of the beam, fixed to the beam with a mortise of iron and screw bolts, with a knee or bend at the neck of each coulter, to make them cut the furrow to the breadth. The sock is fledged on both sides to cut and lift the furrow up to the earth-boards; which, for lightness to the plough, should be of wood, nearly in the fashion of the old Scotch plough, with a piece of wood in the

form of a wedge, on the upper side and back end, to throw the furrow completely out upon the land: in other respects it resembles the common plough; only, it is about three inches longer in the sheath, that is to say, deeper between the sole and the beam. If every part of the plough is truly constructed, (as it should always be,) it will require little more power to draw this than the common plough in ordinary land; but when there are many roots of heath, &c. and the ground very rough, it may require four horses. This plough will be found extremely useful in opening up, and cleaning out open surface drains.

Fig. 2. Inside of a circular saw, see page 233, &c. Very little machinery is necessary in erecting one of these saws; and where there is a thrashing machine, driven either by water or horses, a power can be got to drive one saw, by taking off the axle from the drum, as it is called, of the thrashing machine, and putting on it a pulley or drum for a leather belt, which is put upon a small pulley on the axle of the saw, which generally gives a saw of two feet diameter both motion and power enough. I have often known the whole apparatus furnished and set a working in this way, by a borrowed power, for from seven to ten pounds; but, granting there was a wheel to make for the first power, the whole will not, in ordinary cases, cost above thirty pounds, as there is so little machinery required. A two feet circular saw requires to revolve about 700 times in a minute. Portable machinery of this kind is now in use, and is carried and set to work in woods, wherever there is water to drive it. In this case, a small water-wheel, about eight feet in diameter, and eighteen inches wide in the hem, where there is a fall of water, will be sufficient to drive one to good purpose, and save a great expense of carriage in cutting small wood. A small saw about twelve inches in diameter could be put into a frame, and driven by a man, which would be very useful in cutting up fire-wood about a gentleman's place, as two men in one day with this saw will cut up more fire-wood than two men with axes will do in a week.

Fig. 3. Coppice-thinning chisel, see pages 182 and 188. This is nearly the same as the pruning chisels in general use. It may be two and a half inches broad in the face, from three to four inches long, sharpened on one side, with a wooden handle

of three feet long, and the circle into the handle sharpened on one side. In thinning the stools the chisel is put to the shoot to be cut away, exactly on the top of the stool, with the one hand, and with a small mallet in the other, give it a stroke, so that it may cut off the shoot at once; and, by keeping it always sharp, it will be found to do this easily, without the least injury to the remaining shoots or stool. The circles on the upper end are for cutting off the small twigs, that are intended to grow, close by the eye, by pulling them upwards. This will be found to thin the natural stools of oak far more safely and speedily than any thing yet in use.

PLATE II.

Fig. 4. Portable wooden paling. There is scarcely any landed proprietor but what has great quantities of the thinnings of young larch fir plantations, which, in many places, cannot be disposed of at any price. This fence or paling I mean to be constructed of small larch fir stobs; these, for black cattle, to be four feet and a half, and for a sheep incloseure, five feet and a half long, one inch and a half diameter at the top, and two inches diameter at the root end; two holes to admit a three-eight inch screw bolt in each of them, the one hole within three inches of the top, and the other within four and a half inches of the top of the stob, these put together with screw-bolts three-eighths of an inch thick, at whatever distances the stobs require to be placed, according to the design of the fence. Suppose the distance between the stobs to be six inches, each of the bolts must have a shoulder to keep them at that distance; and the screw the length of the thickness of the stob, each of the bolts having a thumb-nut for the screw, with which bolts the paling is put together. The stobs should go about three or four inches into the ground, according as it is soft or firm; the paling to incline to one side, say about two inches of the plumb, and a spur stob put in at every ten or twelve yards; these also

to be fixed by bolts, the stobs to be rounded in the top, so as not to lodge water, and the whole of the stobs painted with the lime balsam, (see page 429,) which can be made a blue or black colour, by mixing it with the black; the stobs to be all barked, made, and dry, before painted; the part of the stob that goes into the ground to get two coats of the paint, a little thicker than ordinary; a hole to be made in the ground with a piercer before putting in the stob. and the stob put in with a slight stroke, so as not to take off the paint. I mention the larch fir for neatness, but any other kind of wooden stobs will do. They may require a fresh coat of paint every four or five years. If this is properly attended to, a paling of this kind will last for at least sixty years, and the bolts for upwards of one hundred years. One great advantage of this paling is the facility with which it can be put up or removed from place to place, in dividing fields or coppice ground, when only required for one year in one place. Two men, after the stobs are prepared, will put up nearly half a mile in one day. I need not remind the reader, that, when any up-hill or turns are required, it is only needful to bore the holes in the stobs in a slanting manner. The facility of repair, too, is a great saving, as new stobs can be put in with the greatest ease and speed. Nor is this paling at all expensive even at first, as the price of the three-eighth bolts will not much exceed that of the common paling, railing, and nails. This paling may also be put together in parts, with bolts or rods of six or eight feet long, and divide the stobs by forelocks through the rods; but this is not so neat or elegant a way as the double bolts, and they are very little more expensive. This paling is so simple and easily understood, that the figure itself is sufficient explanation, and when done with small larch fir stripped of its bark, which is more smooth than the workman's tools can make it, nothing can be more neat. It is far superior in look to the iron fences now in use about a gentleman's pleasure grounds.

Fig. 5. Peeling larch fir trees growing. This is easily done by putting a pole with a fork on the upper end up to the top of the tree, and resting the other end on the ground; having also a block or pulley at the top end, and a rope to come down, to which, by three folds of the rope, is fixed a piece of wood about eighteen

inches broad and two feet long, with a circular end, to keep it steady to the tree. This board or piece of wood may be in form of a horse saddle, with two holes through it, upon which a person can with ease sit with his legs through the holes, and pull himself up and down the tree with the end of the rope at pleasure, and take off the bark, which will be easily done with the common peeling iron. As the branches of the larch fir tree are generally firm at the top, in order to have the pole at an ordinary length, not to be over cumbersome, the person can go upon the firm branches above the pole to the top of the tree, and peel it down towards the pole. This will be found a very simple and easy method of peeling the larch fir or any tree speedily, after the person has had a little practice.

FIG. 6. Mid-ship floor timber or beam, to cut up into planks, &c.; from nine to thirteen inches of curve, and from fifteen to twenty-five feet long, and from ten to sixteen inches square.

FIG. 7. Rising floor timber or breast hook; from eighteen inches to two feet and a half of a curve, from twelve to twenty feet long, and to square from ten to eighteen inches.

FIG. 8. First futtock; from eighteen inches to three feet of a curve, from ten to fourteen feet long, and to square from nine to twelve inches.

FIG. 9. Second futtock, or upright timber; from one to two feet of curve, from seven to ten feet long, to square from eight to eleven inches.

FIG. 10. Peak or lower transam, approaching nearly to a square; from six to nine feet long, to square from eleven to fourteen inches.

FIG. 11. A knee, which is square, for joining the beams, &c. to the ship's sides; from six to nine feet long; to square from eight to twelve inches.

FIG. 12. Plank timber, stern post, or main transam; from twenty to forty feet long, from nine to eighteen inches square.

FIG. 13. Top timber, straight, except near the lower end, having a curve from eight to fourteen inches.

The above is calculated to suit merchant vessels from 200 to 400 tons burthen, British built. See pages 219, 221, 222.

PLATE III.

Fig. 14. The transplanting machine, put up to a tree while standing to be removed. The root of the tree being re-opened, place two strong planks across, to put the wheels on; then turn the pole up to the top of the tree, and fix it at the top, and make the axle firm by ropes to the tree. It may be necessary to put some straw or old rags betwixt the tree and the ropes, to keep them from hurting the bark of the tree. The tackle also being fixed to the top of the tree, put the end of the tackle fold round the roller of the winch or crane; and, having fixed the winch or crane to the ground by a stob or otherwise, a man at each end of the winch will very easily bring over the tree. Here it will also be proper to have a hand rope over the top of the tree. And as soon as the tree is loosed at the roots, and inclines to come down, the winch must be removed to the other side; and, having still the same rope at it, it must here be used as a guide, to let the tree come easily down on the machine; which can be very conveniently done without the least risk or injury to the tree.

Fig. 15. The portable winch or crane. This is a machine chiefly of cast iron, about three feet six inches high, constructed with two cheeks of cast iron, fixed together by four bolts of iron about one inch thick, and to run on four small cast iron wheels about four inches high, a roller about six inches in diameter, and a small iron axle with handles, with wheel and pinion, the wheel eighteen inches, and pinion four and one-half inches, which gives it a very considerable power: with double tackle, two men will have fully four horse power. As this winch costs very little money, it will be found very useful on gentlemen's estates for many purposes, such as putting heavy logs of timber on carts or carriages, or removing large stones, &c.

PLATE IV.

Fig. 16. Manner of planting belts and stripes of plantation, for inclosing and shelter, for their manner of thinning out, so as

to make the trees stand in a triangular form, &c. see pages from 105 to 109.

FIG. 17. The transplanting machine, with the tree going along the field. All that need be observed here is, that if the branches of the tree be found too long for the upright shaft at the end of the pole, they should be tied up a little with small ropes, to keep them from rubbing on the ground. It may here be proper to observe, that the tree on the machine must be drawn along by the root-end.

FIG. 18. The machine for transplanting trees. This machine consists of two wheels, which should be at least seven feet high, and of considerable strength. As it may be useful for many more purposes, they should also be at the least six inches broad in the hem, so as not to sink into, or cut the fields in passing along. The axle should be fully as strong as that of a cart axle. This axle should have a bolster of wood on it, with a circle cut out in the middle of it, so as to keep the tree steady when it is upon it: the pole about six by four inches, the wheel at the end of the pole to work upon a swivel, such as a castor. Should the tree have very long branches extending sideways, the perpendicular shaft at the end of the pole may be made longer. In this case it might be well to have a spare one of additional length: as it is fixed into the pole by bolts, it can very easily be put in and out. This machine will be found very useful for many purposes, such as removing timber in the log, &c. which is hung under the axle.

PLATE V.

EXPLANATION OF THE MEASURING MACHINE.

FIG. 19. A represents a bell on the end of the axle which the main wheel runs on. B is a steel spring, which is lifted by a pin in the hem of the large wheel, which causes it to strike the bell at every twelve inches, which will be distinctly heard from the top of the highest tree. C is the handle which works on the

main axle, like scissors, one on each side of the large wheel; one of the connecting rods goes into it, and is fixed with a screw, making a swivel joint, and by screwing the nut firm, the wheel can be set to any position, and it will work equally well any way. D is a small hand in the circle of the triangle that points to the inches, or quarters of an inch, on the wheel, and tells what is more than the inch after the spring is struck. E is a spring that strikes at every inch. F is the ring of the large wheel, which is calculated to measure exactly two feet, and is divided into feet and inches, and fourths of an inch, and is like saw teeth on the hem, and goes round the tree, and tells the circumference in feet and inches by the striking of the springs. G, the inside wheel, in which are twenty-four pins, lifts the spring E, which strikes at every inch. H is the triangle which runs also on the main axle, and rests on the basis of the tree, and slides along while the wheel goes round; and the springs being fixed to it, gives the measurement in feet, inches, and fourths of an inch.

Fig. 20. The rods for working the measuring machine, with it at work, each rod three feet long and one inch in diameter, with connecting screws of brass on each end of them; so that as many as are required for any length or height can be easily screwed into each other. The other small rods for taking the length of the tree, as also of its branches, are only five-eighths of an inch in diameter; each rod is also three feet long, and goes together also with connecting screws of brass. The rods are painted black, and divided into feet and inches, with white letters, so that, when applied to the tree or any of its branches, the feet and inches can be distinctly read from the ground. By connecting any number of the rods together that may be required, and by applying them to the tree or branches, as shown in the plate, you can take the exact length of the main body of the tree, or any of its branches, in feet and inches, at sight; which is both a speedy, accurate, and simple way of measuring standing trees, as to their height, or length of measurable branches.

PLATE VI.

Fig. 21. The rods, taking the measurements and dimensions of the branches of a tree.

OF WORKING THE MEASURING MACHINE.

The method of measuring round timber trees is accurately described by Mr. Hoppus, in his excellent book of measurements, and as his is the standard and customary measurer, I would refer the reader to it in measuring unequal grown trees. After having taken the length of the tree in feet and inches, which length may be taken by the rods, as already described, the girth is most generally taken at half the length; which girth we may now proceed to take with the measuring wheel. This is easily done, by putting up the wheel (see Fig. 20,) with as many of the connecting rods together as will easily put it up to the height required; then, suppose there are no branches in the way, and having before made a mark on the bark of the tree with the small rods, which have in the end of the uppermost one a small marking iron for that purpose. This mark is made where the girth is to be taken, and from where you are to take your departure with the wheel; which being done, press the wheel round the tree, following it, and keeping it as level as possible; which the wheel will in a great measure do of itself, by its having teeth like a saw in the hem of the wheel, unless carelessly attended to; and as the wheel goes round the tree, be sure to count the number of times the bell strikes, which strikes at every foot; and when you see you have not another twelve inches, or one foot more to run, come back again to the place where you took your departure from, count the number of inches that it strikes over and above the last foot, and thus you will at once have the feet and inches that the tree is in circumference; of which take the fourth, and this gives you the side of the square. But when there are branches in the way of getting round the tree, you must have a spare handle for the machine, as C, about two feet, or two feet six inches in length; and by altering the swivel joint at the top of the first rod to any position required, the person working the wheel by the rods can stand in the same place, and put the wheel half way round the tree, if it is very large, turning the swivel-joint, and reversing the wheel, at the same time sending it round the other side of the tree, till it meet where it left off; and by counting the feet and inches, as above, and adding the two together, you will at once have the extreme girth of the tree; by taking the fourth of which girth, you have the side of the square: thus one person working the small rods, taking the lengths, and marking for the girths. When branches are to measure, or when branches are in the way of getting round the tree with the rods, the person with the small rods stands on the opposite side of the tree, and directs the person when to stop with the wheel. Thus, by a little practice in working the wheel, and paying attention to count the feet and inches as they strike, two men will measure growing or standing trees as accurately and as expeditiously as if the trees were lying on the ground. A very little practice in working the machine will soon convince any person. The wheel being about eight inches in diameter, it strikes two feet before it goes once round, at the same time striking at every foot. Although the tree should have some hollows in it, it will be found to take the girth as correctly as a line will do. In taking the girth of round trees, the girth should always be taken where the tree is most equal, and free from any swell or hollow places, taking the medium of the tree for the girth, as directed by Hoppus. Indeed, some trees, such as spruce fir, may be so loaded with branches, that it may be impossible to get the machine at all in amongst them to take the girth; but this is only likely to happen in a tree of that kind, and may not happen in one tree out of a thousand. If the tree is such that you can get in the machine to where you are to take the girth, and if you can see where you take your departure from, and make your stop at, you can be at no loss to take the exact girth; and, by a few days practice in measuring with this machine, it will be found to measure more speedily, and as correctly, if not more so, than taking the girth with a line, as by a line you have first to put it round the tree, then you double it, and apply it to a foot rule; you then take the half for the side of the square, whereas this machine gives you the exact feet and inches from the top of the highest tree, without the help of any other rule. This machine will also be found very useful in taking the length of logs, but especially crooked timbers, as you can easily run it along the centre of the curve; which is the fairest way of measuring crooked timber. It may also be applied with advantage to take the length of a large crooked limb of a standing tree, where there is one of the sides clear of small branches, by running it up the centre, as already described.

PLATE VII.

Fig. 22. Coppice trees at fifteen years old.
Fig. 23. Coppice trees at twenty years old.
Fig. 24. Coppice trees at twenty-five years old.
Fig. 25. Coppice trees at thirty years old.

See the figures of these trees described in Section VII. VIII. and XXVII. with the manner of cutting, thinning, and valuing, &c.

PLATE VIII.

Fig. 26 represents a fir tree, the branches of which have been allowed to rot off, and of course leaves a blemish in the tree.—See Section XXIII.

Fig. 27 represents an oak tree properly pruned; and in order to make it grow crooked, the horizontal branch is kept on the main stem, and the perpendicular one loped off, and otherwise pruned in the top, in order to make it grow more crooked. —See Section III.

Fig. 28 represents an oak tree, such as figure 2, and having been dealt with when young as figure 27, has become a fine crook, the horizontal branch having become so strong, and has such unevenness of curvature, as to work in with the main stem, and will answer almost any purpose about a vessel, and of course is the most valuable of all trees.—See also Section III.

FIG. 29. Method of layering. See this explained and described in the Section on Planting, from pages 88 to 100. All that is necessary to be said here, in the explaining of the figure, is, that all unnatural twigs or shoots that come off from the stem, laid down betwixt the shoots, to be reared for trees, should be cut off, unless when these may be required to be layered out to fill up corners sideways; and when this is required, the layer should have another year or two's nourishment from the main root before it be cut off. The figure itself at once shows the simple and easy manner of laying, which is a sufficient explanation.

PLATE IX.

FIG. 30. Boiler, &c. For extracting the liquid from the timber, this boiler must be of cast or malleable iron, and should be from five to seven feet long, three feet wide, and say four feet deep from the top of the arch, built with fire brick, &c. up to the top. The wood is split or round, not to be more than three inches square in thickness, and at any length, so as to go into the boiler, which is put into the boiler at the door; and, when full, the boiler-door is properly secured to keep in the steam, then the fire is put to it in the furnace below, and the liquid comes off in the pipe above, which is condensed in what is commonly called a worm, in a stand filled with cold water, and empties its contents into a spout below in barrels, or any other vessel; and thus the liquid is prepared. Observe the stand must always be supplied with cold water. This operation is extremely simple and easy. One English ton weight of any wood, or refuse of oak-wood, will make upwards of eighty gallons of the liquid, which is used for different purposes. See page 349. The wood, when taken out of the boiler, may be used as charcoal, or as fuel for the boiler. There is also a quantity of tar extracted, which may be useful in ship-building. A is the boiler, B the boiler-door at which to put in the wood, C the furnace-door, D the pipe, E the cold water stand, F the cold water spout, G the spout for taking the liquid into the stand or barrel.

PLATE X.

Fig. 31. Dry rot steam-stove. From what has been already said in the section on dry rot, very little explanation is here required, as all ship-builders are well acquainted with a stove for steaming their planks, to make them bend: suffice it to say, that this stove must be of cast iron, and of such dimensions as to admit of the largest piece, or log of timber, in general used at their work; and when smaller pieces are required, the stove may be filled with a number of them at once, which will do equally well. The door of the stove, where the logs are to be put in, may be lifted with a wheel and pinion in a frame for that purpose; and for ease in pushing it along, there may be rollers of cast iron in the stove to run it on. Observe, that the fires in the furnaces below the stove must be kept going, till what of the liquid may have been thrown into the stove by the steaming is completely exhausted, and dried up into the timber of the logs or planks, &c. till it is scorched with the fire, as directed in the Section on the cure of the rot, &c. A is a cistern for supplying the boiler with the liquid, B the boiler, C the steam-pipe, D door for putting in the lime shell, E the steam-stove, F the rollers inside of the steam-stove, G furnace-door for the boiler, H furnace-doors for firing the timber in the steam stove.

PLATE XI.

Fig. 32. Dissection of Plate 10, the steam-stove, &c. &c. with a species of a crooked or bent stove, which will be necessary for crooked timbers. The little or trifling expense attending the curing of timber in this way about a ship-building yard, will easily appear to every person, when he considers the large quantity of liquid extracted from a ton of timber fit for nothing but burning, of which there is always a great quantity about a ship-builder's work; and the trouble attending it will be nothing in comparison with the advantages gained by it. Wood-merchants too should have a stove of this kind in their yards; as no

person intending to build a good house would ever scruple or grudge paying one penny or even twopence per foot more, to have his timber seasoned for him to last for centuries, and not to have the joisting of his houses to renew in a very few years. It may be said, that it is a fact admitted, that I have not lived, and never will live to see this verified in its full extent; but I have lived to see it verified in putting a most effectual stop to the ravages of the rot; and from the trials I have lived to make, I can boldly aver it will most assuredly do it; and as to its making all kinds of timber more durable, and to resist all kinds of damp, wet, air, and worm, there will, with every unprejudiced person, be but one opinion.

PLATE XII.

FIG. 33. Elm tree on the estate of Touch, Stirlingshire. My reason for giving a figure of this tree is, that it proves to demonstration the different crooks and shapes that by a timely attention to the growth of trees they could be brought to grow to; the crooked branch of this tree had evidently once been the main stem, but was kept down, I am told, by children *swinging* upon it when young. Hence it has, as will be seen by looking at the dimensions, been brought to form crooks nearly equal in largeness to the bole of the tree. This tree affords a very great natural curiosity to the eye of a lover of trees.

My introducing the three following Plates may, by some of my readers, be counted presumptuous, as they will appear more of a private and local than of a public nature.

These engravings were prepared some years ago, partly at the request of some of the proprietors, and chiefly to satisfy my own curiosity; as many questions had been put to me, particularly as to the plane tree at Kippenross, when I was at a distance from it; as also it served to refute a false account of its dimensions which had gone abroad, in mistaking the feet and calling them yards. Allow me farther to observe, that these plates being previously prepared, there is no additional charge made on the book on their account.

PLATE XIII.

Five Scotch fir trees on the estate of Airthrey, Perthshire. These trees, as will be seen by the engraving, stand on very little ground; and, till a person reaches within a very few yards of them, they appear to be one tree. They are said to be of a very great age, yet are still healthy and thriving in 1824; they are of the same species of fir as those very large trees about Inverary Castle; they grow on very bare soil, and I am of opinion, not far from limestone rock. About a year ago there was a small branch broke off one of them with the wind; although not much thicker than a paling stob, it was all red wood, in colour resembling laburnum, and nearly as hard, which is proof positive that there is no fir timber equal in quality to the old Scotch firs.

PLATE XIV.

Ash tree on the Estate of Carnock, in Stirlingshire. This tree grows very near to the house; and, I believe, is nearly the largest in Scotland, when measured at the smallest part of the trunk. It grows upon a dry light soil; and although not at a great distance from Carse and clay land, I believe it is on freestone rock. It is very healthy in 1824, and a beautiful tree. I can find no account of its age.

PLATE XV.

Plane tree, on the estate of Kippenross, Perthshire. This is the largest plane tree in Scotland, and, if I be rightly informed, nearly the largest in Britain; it has begun to decay in the trunk, and some parts of the branches; but some years ago the proprietor was at some considerable expense to preserve it, covering over the places with lead, &c. In summer 1823 it received some damage from a thunder-storm, but is still healthy in the top,

1824. One great curiosity in this tree is, that one of the branches above the cleft girths is twenty-one feet, being three feet more than the trunk of the tree: this tree grows on dry field soil, above a hard freestone rock, to which there is no great deepness. When the present house of Kippenross was built, there was a quarry opened up within a few yards of its roots, and the large stones were taken up out of the quarry by tackle fixed to one of the branches of this fine tree, which was by this usage broke off and allowed to remain in its shattered state, as is seen in the engraving, till it was cut off and covered with lead a few years ago, as already referred to. The Right Honourable the Earl of Marr has favoured me with the following anecdote as to its age. "Mr. John Stirling of Keir, who died in 1757, had made many inquiries of the old people from eighty to ninety years of age, which takes us back to the reign of Charles the II. near the Restoration; they uniformly declared that they have heard their fathers say, that they never remember any thing about it, but that it went by the name of the Big Tree of Kippenross."

It was once my intention to give a description of the most of the largest trees in Briton, but this would be more curious than edifying, and the volume has already far exceeded the bounds I had at first prescribed to it. I must at present decline it; at some future time I may resume the task, by giving, in a small volume, an engraving of the most remarkable trees in Britain, with anecdotes and descriptions of their size, soil, situation, &c. so as to serve as a pocket companion, which will both amuse and entertain the traveller as he passes the places where they grow, this subject being altogether inexhaustible.*

And to conclude, allow me, forester, to tell you that you have both an ancient and honourable trade; and as trees far outstrip the life of man, if you do your profession justice, they will testify to your memory and speak peace to your ashes after you are gone; if you do not every forsaken twig will blast your fame. To some foresters I can say, " well done good and faithful servants;" but to others I may say, " How long wilt thou sleep, O sluggard, when wilt thou awake out of thy sleep?" Always take delight in, and make your profession a pleasure, not a toil. Solomon was both an ancient and honourable king, and he delighted in, and wrote of, trees, from the lowest shrub to the tallest cedar. The ancient poets sung of trees: Virgil has the following exquisite lines:—

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* Not a tree
A plant, a leaf, a blossom, but contains
A folio volume—we may read, and read,
And read again, and still find something new;
Something to please and something to instruct
Even in the humble weed.

As o'er the aerial Alps, sublimely spread,
Some aged *Oak* uprears his reverend head,
This way and that the furious tempests blow,
To lay the monarch of the mountain low;
Th' imperial plant, though nodding at the sound,
Though all his scatter'd honours strew the ground,
Safe in his strength, and seated on the rock,
In naked majesty defies the shock:
High as the head shoots towering to the skies,
So deep the root in hell's foundation lies.

Where shall we find a match for Virgil's imperial monarch? Must we scale the Alpine mountain? No, but let us cast our eyes to the Highland mountains* and groves of Britain, and see her, in the following most beautiful lines, a match for all the world!—

From a small acorn see the oak arise,
Supremely tall and towering to the skies!
Queen of the groves, her stately head she rears,
Her bulk increasing with increasing years!
Now moves in pomp, majestic o'er the deep,
While in her womb Britannia's thunders sleep;
With fame and conquest graces Albion's shore,
And guards the island where she grew before.

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* There are many trees about Inverary Castle, the seat of the Duke of Argyle, measuring upwards of 300 solid feet, and many oaks and Spanish chesnuts worth from L.60 to L.90 sterling.

PLATE XVI.

FIG. 1. Figure 1 represents a natural stool of oak or Spanish chesnut, to be trained up with crooks or binds for ship-building. I may observe here, by the way, that to have sound natural bent or crooked oak timber for ships, is one of the very greatest national improvements. It is a well authenticated fact, that all that the ingenuity of man can invent, has fallen far short and deficient of making straight timber crooked, of any thing like either strength or durability to the natural grown crooks; hence, the schemes of boiling and steaming, and all other schemes, to make large timber stand to certain bends and crooks to carry any burden, has vanished into air; even the bending of thin ship plank by steam, does, in a great degree, weaken the strength of the timber. The most of the crooked timber at present obtained, is by cutting off one branch or limb of a tree, where two branches diverges from the same place of the tree, so that one of these branches or limbs are made to work in with the trunk, and to form the bent required; this often, with a considerable lose of timber, the one part being larger than the other, and both requiring to be worked to the same size, and always with, having at the very knee, or extreme curve, a knot or cross grained timber, and of course not equal to clean natural curves, either in strength or durability; hence, we often see the knee in ships give way, or break at the very crook or place where they should be strongest, and this owing to cross hewn timber. Thus, it always happens when side branches must be worked in with the trunk of a tree to make crooks, there is both waste of timber cross hewn, and an insufficient knee or crook. Another cause of insufficient crooks is, when branches are cut or pruned off trees after they are come of considerable size, as timber, because all the blemish may be grown over before the tree be cut down, and no fault visible, yet, when hewn to the shape and crook by the axe, the blemish appears, and the piece of timber often lost; or should the fault not be so much as to prevent the piece of timber from being used, yet it is always weakened hereby, and that too in the very place where it should be strongest. It is well known, that in almost all trees of old standing, there

are blemishes and faults in the timber where they divaricate. Proper clean grown natural bends of oak timber is always in demand, we may say twenty feet to one, and these crooks always sell for two or three shillings more per foot than straight timber, so that it is of the very greatest imaginable importance to grow and rear up sound equal grown crooked timber, all which has been already insisted upon, and plans suggested, which has been found, not from my own experience only, but the experience of many others, to answer, (in so far as single trees are concerned,) the purpose; but in planting and rearing solely for profit to the extent of acres and whole plantations, we must carry the matter a little further; and I hope I will be pardoned when I say, that the scheme is worthy the notice of the managers of the government forests, and they would do well to take the hint. The most effectual method then for rearing a supply of clean sound equal grown crooked timber, is from natural growing shoots, where the stool or root is of sufficient size to rear up three shoots or trees from it, and to begin to train these up the first season after being cut over, taking special care always to leave the stools in the back ground, as in Figure 2 and 3, so as to overtop and bear down the outside shoots of Figure 1. This can be done in all coppice woods, but with greater success, and more speedily, where the stools grow on the side of a bank or a hill, where the shoots from the stool on the rising ground can be always and easily got from the first year's growth, to overtop those on the lower side.

Fig. 2, 3, 5, 6, 8, 9 and 10, are all meant to represent the same manner of rearing and training up crooked timber; carrying this plate into the coppice, and singling out the stools, so as to stand in the back ground—pruning, rearing, and training them up, the one to overtop the other, the whole plate itself lights up the torch of instruction, and a trial of it in the wood will at once give proofs of its utility, more than volumes of theory, having, in thousands of instances, experienced the result.

Fig. 4 and 7 represent standril trees round the outskirts of a coppice wood, whose branches may also be trained up to overtop natural growths to assist their growing crooked, the rearing up of which will add greatly to the profit of natural woods.—(See pages 198, 199, 200.)

Fig. 11 represents a paling of small larch-fir stobs, which is both cheap and durable; they may be put together with pins made of the redwood of oak, in place of nails; which pin should have a thick shoulder on the one end, and drove always from opposite sides; these will last a long time, and if the stobs are carefully selected from thinnings of young Larch firs, it will be neat and pleasing to the eye; the thing of itself is so simple and plain, that it needs no farther explanation.

Fig. 13 is another kind of small wood paling, commonly called stake and rise paling, and is also very cheaply erected, and, if done with Larch fir, very durable. This kind of fence is of general use in dividing coppice haggs, or yearly cuttings, where it is only required to stand for one or two years, in which case it is put up with the oak cuttings; and when these haggs or cuttings are disposed of by the proprietor, as much of their cuttings are reserved for the proprietor as will be sufficient for such a fence.

In making such a paling of larch stobs, and the warpers of larch fir branches, they will last for many years.

Before finishing the subject of enclosing ground, where it will admit, throw up a fail dike two and a-half or three feet deep, sloping it as an ordinary sunk fence, cut over Hazel; and remove their roots, and plant the roots close on the top of the dike so cast up, and in one year's growth you will have a complete fence against sheep; and if care is taken to keep it from falling into gapes, by warping the growths, it will be for ever fenceable, as the roots will keep up the fail dike. This may also be done by a stone dike of the same height, where the ground cannot be cut, being rocky, and a sufficiency of earth laid on the top of the dike, and the roots planted; by this method, a fence is at once cheaply and permanently obtained. The novation of the spruce fir as a fence, in another part of this work, will be found the most beautiful hitherto invented, (the holly not excepted) as the spruce fence will, like the holly, stand the same in winter as well as summer, and that the spruce fir will succeed by layering them down on their sides horizontally is beyond all shadow of doubt, and makes a most complete fence against sheep and cattle of every kind.

ADDENDUM.

I OF GATE-MAKING, COMBINING ELEGANCE WITH CHEAPNESS AND DURABILITY.

Quarterly Journal for August, 1829, a plan of a gate is iich the writer says will last for thirty years, at an ex- L.2, 7s., made of the best Memel timber.*

; made gates of various descriptions as a practical gate- profess to know something of the art, and shall briefly o kinds of gates which I conceive will be found much ind more durable than the one described.

st I would term the wood and iron gate; this is com- two horizontal cast or malleable iron bars, the under inches broad by three-eighths of an inch thick, the it two and a half inches broad by three-eighths of an k, the extreme length, which is to be the length of the it feet six inches, (more or less as may be necessary) two malleable or cast-iron bars two inches broad, half-inch h, and having a grove to admit the ends of the hori- rs, with a check on each side and two small bolts to firmly to the horizontal bars, each of the horizontal bars welve projecting round sockets about an inch and half in on each side equally divided, each in a diagonal posi- front sides running in opposite directions, these to be th round pieces of wood, bolted with a small iron bolt a the centre to each other; the wooden spars or rundles made of small Oak, Ash, Elm, Birch, Willow, Poplar, fir, which when painted will last fifty years.

f this gate, weight of the whole cast-iron as ascertained, inder 1 cwt., which will be nearly as follows:—

idred weight of cast-iron bars .	£0	14	0
k for hinges, snake, and bolts .	0	5	6
r the spar	0	2	0
inship and paint . .	0	3	6
castor or pulley . . .	0	1	0
Total	£1	6	0

, in this gate the hinges are cast on and attached to the bars, so that there is only the bolts through the post . A gate constructed on this principle and of the above materials will be both durable, elegant, and cheap, and will last, with the replacing of the wood part of it, for centuries, only costing about 5s. 6d. every fifty years. I may observe, that for the purposes of support, all gates should have a castor or small wheel in the foot of the swing bar, with a piece of iron projecting from the post, so that when the gate is shut it may rest upon it; this iron rest may taper a little on both sides from the centre, so that the gate may play easily upon it. See plate VIII.

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* Fir or old full-grown Scotch Fir, when well seasoned, will cost ast as long as Memel timber.

A second kind of gate may be made on the same principles, but wholly of wood, with the exception of cast-iron boxes or sockets on the sides of the two horizontal rails or bars, which may be fixed on them with small screws to receive the ends of the diagonal spar rundles; when the bars are made of wood they would require to be of the following dimensions, the under bar four and a half inches broad and one and a half inch thick, the upper bar three and a-half inches broad, and one and a-half inch thick, the two upright bars three inches by one and a-half inch, with iron hinges attached; these bars would require to be made of the best Oak, Ash, Elm, Spanish Chesnut, or Larch fir, well seasoned, and the diagonal bars of any of the same. A gate of this kind, well made, will last for forty years, be very light on the hinges, and not cost more than L.1, 1s.

This wood and iron gate could, with much propriety and advantage, be converted into a portable pailing, similar to Fig. 12 on Plate XVI. by having one ground horizontal bar, into which are to be the rundles or stobs, as in the gate—say in lengths of ten feet each, or thereby,—with a cross bar eighteen inches long, placed at each end with a notch to receive the long bar, to keep it stationary and steady. These as a pailing would be exceedingly neat, durable, and easily removed from place to place, in dividing fields, and about pleasure-walks, &c. As the wooden rundles could be made to slip out and in at pleasure, by using small thumb screws, they would be exceedingly handy in dividing turnip fields for feeding sheep; the expense would be very trifling, and their durability immense. A stone with a notch in it, may supply the place of the cross bar, but cast iron will be more handy when to be moved occasionally. This pailing could also be put up on rocky or marshy ground, where the common stob pailing could not be used, and will be more elegant than dry stone dykes, and kept up at less expense.

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